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THE UNIVERSITY OF ALBERTA

A VALIDATION OF THREE INSTRUCTIONAL PROCEDURES FOR EARLY LANGUAGE

by

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A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
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FACULTY OF GRADUATE STUDIES AND RESEARCH

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ABSTRACT

The present study had two main purposes: first, to compare the relative efficiency of two sequences of imitation and comprehension training; and second, to compare the effects of simultaneous vs sequential presentation of imitation and comprehension training. Efficiency of a particular training procedure was judged in terms of: sessions to criterion; short term (5 days) and long-term (5 weeks) maintenance; generalization; and effect on production probes and subsequent production training.

Three training conditions were investigated in this study. In the first condition (IM/COMP) imitation was trained before comprehension. The second condition (COMP/IM) reversed the sequence of imitation and comprehension training. In the third condition, (SIM) imitation and comprehension was trained sumultaneously. For all three conditions, production probes were administered during both imitation and comprehension training. Children received production training following imitation and comprehension training for items on which they failed to reach criterion during production probes.

Experimental subjects included six preschool age moderately/severely handicapped children (four girls and two boys). S1 and S2 received all three conditions; S3, S4 and S5 received two of the three conditions; and S6 received one of the conditions.

The results indicated that children taught in the IM/COMP sequence required fewer mean sessions to criterion, and reached criterion on a greater percentage of production probes. Children in the SIM condition exhibited greater generalization to a different stimulus object, a different setting, and a different teacher. Children in the COMP/IM condition had fewer articulation errors on words reaching criterion during imitation training when compared with the other two conditions. All three conditions resulted in both short term and long term maintenance. The three conditions did not have a differential effect on production training.

On the whole, the IM/COMP condition was judged the most efficient procedure to teach imitation and comprehension training.

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CHAPTER I

INTRODUCTION

Over the past five years, there has been a marked increase in the number of programs and curriculum guides for the education of moderately, severely, and profoundly handicapped individuals. In general, the programs use behavioral techniques to teach developmentally sequenced behavior, (Anderson, Hodson, and Jones, 1975; Bender and Valletutti, 1976; Fredericks, Riggs, Furey, Grove, Moore, McDonnell, Jordan, Hanson, Baldwin, and Wadlow, 1976; and Johnson and Werner, 1975) to name a few.

The upsurge of program and curriculum development is due in part to the passing of the National Education for All Handicapped Children Act (P.L. 94 - 142) in the United States in 1975. This act provides for the education of all children, including even the most severely handicapped. It entitles the handicapped to a free, public education in an environment suited to his/her needs for six hours per day (Sailor and Haring, 1977). Although a similar act has not been passed in Canada on a national level, the problem of educating all children without regard to handicap is being dealt with at the provincial level. For example, the Province of Alberta is committed to the provision of a free public education for all children over six years of age regardless of handicapping condition (Alberta Education Grants Order, Note 1).

As a result of providing public education programs for school-age handicapped children, there is an increasing demand in the United States and Canada for curriculae suitable for children with a variety of handicapping conditions. Two problems associated with this increased demand have come to light:

(1) Educators have found themselves in the position of having to re-educate some teachers to deal with the school-age handicapped population. Current teacher education programs are being revamped to include courses on how to teach handicapped children, especially severely/profoundly retarded multiply-handicapped individuals (Brown and York, 1974; Fredericks, Anderson, and Baldwin, 1979; McCormick, Cooper and Goldman, 1979).

(2) Because of the increasing demand for packaged programs and curriculum guides suitable for the handicapped population, programs are being disseminated before they are adequately validated. This is particularly true in the area of language programming (Connell, Spradlin, and McReynolds, 1977).

This study is concerned with the second problem, that of program validation. More specifically, the present study investigated the relative efficiency of three different procedures to teach early language skills to language deficient preschoolers.

Chapter Two reviews recent literature dealing with program validation. Chapter Three discusses the rationale of the present research. A description of the method to be used is provided in Chapter Four. The final two chapters (Chapter Five and Chapter Six) provide a description of the results of this study and a discussion of the results respectively.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

The rapid integration of large numbers of handicapped children into the public education system has turned out to be a mixed blessing. On the one hand, these children are finally entitled to a public education which is their right. On the other hand, a large number of programs are being developed that are not being validated before they are disseminated. For the purpose of this study, program validation refers to the comparative analysis of instructional sequences in order to determine if a particular program sequence is the more efficient than an alternate sequence.

It is difficult to find instructional programs or educational curriculae that:

(1) describe the population on which they were used; and

(2) validate the program sequence in one setting, then establish external validity by replicating the program in different settings with different teachers (Edgar, Maser, Smith and Haring, 1977).

Bijou (1977) gave a clear statement of the problem being faced and a solution:

> A programmed sequence does not materialize by declaration. It results from carefully conceived and well executed research. (p. 11)

There is a demand for more educational programs, therefore more programs are produced. As was indicated above, many of the program sequences have evidently materialized by declaration. Very few have been scientifically validated. The teacher of a handicapped child or children who requires educational programs is faced with the formidible task of deciding which curriculum (or curriculae) is appropriate for her student population. This task is further complicated as one is rarely given sufficient information to make this decision objectively. Some teachers in the field are becoming so discouraged that they are encouraging other teachers to develop their own curriculae (Poplin, 1979).

In this chapter, a general discussion of program validation will be followed by a review of the implications of task analysis for program sequencing and program validation. The following four sections deal specifically with language program validation.

Program Validation

General. Connell et al. (1977) discussed the problem of language program validation and suggested the minimum information that language programmers should provide with their packages. Although only language programs were discussed, the same suggestions can be applied to all programs for the handicapped. Connell et al. (1977) stated that the programmer should supply adequate effectiveness information such as:

(1) mean trials to criterion and variance for each program step;

(2) percentage of clients who passed each program step;

(3) an experimental analysis of generalization of the behavior taught. These points are discussed in

detail below.

1. Mean trials to criterion and variance for each program step

   Mean trials to criterion for each step (defined as the average number of trials students require to learn a particular program step) may benefit the teacher in two ways:

   (i) The teacher may compare mean trials to criterion for each step obtained with her students to the mean trials to criterion for each step in the population with which the program was previously used. If her students' trials to criterion are on the average somewhat higher, the teacher has at least three options:

      (a) She may go back and change her instructional procedures;

      (b) She may contact the authors for more information on their procedures;

      (c) She may decide to place the children on a different program.

   (ii) The teacher may determine if one or more of the program steps are out of sequence. If the mean trials to criterion show a large jump from one step to another, she may decide to teach that step later in the program or add additional steps between the last step and the problem step.

The variance or range of scores around the mean for each step would allow the teacher a further comparison of her students with the original population. If the teacher has one or more students that are well out of the range for many of the steps, she may decide to place these children on an alternative program.

2. Percentage of clients who completed each program step
   If this information was available to the teacher she would be better able to compare the efficiency of two or more programs that would teach the same behavior. For example if two programs taught severely retarded ambulatory adolescents to take a bus from home to school unassisted, and one of the programs indicated that 100% of the students completed all steps of the program, whereas 50% of the students completed the second program, she could choose the program that would increase the liklihood of her population completing the program.
3. An experimental analysis of generalization of the behavior taught - If a particular program seemed appropriate for the teacher's population but children completing the program showed poor generalization to new settings, the teacher could anticipate this and directly program for generalization to new settings.

A fourth component would seem appropriate as a part of packaged programs and curriculae being disseminated. It is important to specify precisely the population on which the program or curriculum was field tested. In the area of "severely handicapped" it is sometimes difficult to determine how "severely handicapped" the subjects were when tasks such as arithmetic skills and independent living skills are discussed. A teacher of profoundly retarded non-ambulatory children might find a curriculum for the "severely handicapped" inappropriate for her population because the curriculum was tested on a group functioning in the moderately retarded range. Subject characteristics such as I.Q. (where appropriate) functioning level as assessed on criterion-referenced assessments; communication skills (both expressive and receptive); whether or not the subjects were ambulatory, could all be useful information to include in a program or curriculum guide. Problems will continue to arise because of the difficulty in defining classifications such as "severely handicapped" (Baker, 1979).

In summary, Connell et al. (1977) suggested that:

(a) the public should refuse to use programs that do not supply the above information, and

(b) consumers should not experimentally test the programs themselves, since this will only encourage more people to distribute more untested programs.

Unfortunately, boycotting unvalidated programs is not a viable solution for educators at this point in time. The need for programs is great and validated programs are scarce. For the present, the only option to the consumer is to attempt to validate programs experimentally while they are being used.

It appears that the major question to be addressed by educators is not "should packaged programs be validated?" but "How may packaged programs be validated?" Dunst (1979) pointed out that the Education for All Handicapped Children Act (P.L.) 94 - 142 specifies that programs administered under this act must be adequately evaluated. It seems clear that interest in program validation is increasing and in some cases, is mandated by law.

Validation of Instructional Sequences. The problem of how to validate programs remains to be solved. Most of the literature relevant to the issue of experimentally validating training sequences and learning hierarchies has been in the area of task analysis and instructional design (Gagné, 1974; Poser and Strike, 1976). This approach sheds some light on the task of comparing different instructional sequences to teach the same behavior in order to determine the best sequence for teaching a particular behavior (or behaviors).

Until recently, it has been assumed that people developing learning packages of task-analysed material felt responsible to the consumer and adequately tested the material before distributing it. To date, few programs have been found which attempted to empirically validate teaching sequences by testing the sequence with a number of students in several settings (Cuvo, Klevans, Borakove, Borakove, Van Ladvy and Lutzer, 1980; Edgar et al. 1977; Knapczyk and Dever, 1977; McCormack, 1976). In the absence of published validated teaching sequences, people other than those developing the learning packages have taken it upon themselves to develop means of assessing programs and instructional sequences (Baine, 1978; Borich, 1977; Cuvo et al. 1980; Guess, Horner, Utley, Holvoet, Maxon, Tucker and Warren, 1978; Poser and Strike, 1976; Weber, 1977).

Two studies could be found which considered evaluation procedures for entire programs on a large scale. Weber (1977) described a method for evaluating and auditing learning packages using the competency-based instructional approach. The method used by Weber (1977) to evaluate 500 learning packages was to provide a "blueprint format" of the program to be evaluated. A matrix was formed with the two principle axis being program components (students, instructional materials, staff, administration, cost factors, teaching activities, affective outcome) and decision components (program goals, operationalized outcomes, data collection format, criteria, judgment alternatives and decisions either favorable or unfavorable about a program component). Once a learning package has been analyzed with this matrix, decisions may be made on such things as appropriateness of skill sequencing and content validity.

Similarly, Borich (1977) described a method for analyzing an entire program in order to evaluate hierarchies within the program, their order, and how they are related. Both of the above articles suggested that program sequences should be empirically validated. One way to do this was to organize the sequence in a number of ways to determine which sequence would be most efficient to teach a target behavior.

Narrowing the scope of evaluation, educational researchers have been concerned with procedures that might be used to validate alternate program sequences in general curriculum areas (Guess et al. 1978a; Poser and Strike, 1976; White and Gagné, 1974). Poser and Strike (1976) found little data in the literature on the consequences of using alternate sequences to teach the same behavior. They stated that before we can determine how program content should be sequenced, it is important to determine in what way the content may be sequenced. The sequence may be concept-oriented and reflect the organization of the conceptual world; utilization-oriented in that the steps are sequenced in the order in which they will be followed when the procedure is carried out; world-oriented such that a consistency exists between the order of presentation of the content and the phenomena as they occur in the world; learning-oriented in which one draws on psychology for information on the sequencing of the material; as well as inquiry-oriented, implimentation-oriented, or any combination of the above. Poser and Strike (1976) concluded that although the problem of sequencing has received much attention over the past 70 years, no satisfactory answer as to the best way to sequence materials has been reached.

Gagné (1965, 1974) discussed an approach to sequencing that appears to be most relevant to this study. He took a logical/empirical approach to sequencing task material and his method may be described as learning-oriented (Poser and Strike, 1976). Gagné (1965, 1974) stated that attention must be paid to prerequisite behavior if optimal learning at any level is to occur. Higher or superordinate capabilities will be more quickly learned if the lower or subordinate skills have been previously acquired. Particularly important to this study is the claim that students learning of a task will be greatly facilitated (they will take less time to learn the task) if they first learn the relevant prerequisite skills when compared with students who have not learned the prerequisite skills. Gagné's rationale is that there is transfer from the prerequisite skills to the higher skills and learning is thus facilitated.

White and Gagné (1974) found that skill hierarchies can be positively or negatively validated. A hierarchy is positively validated if it can be shown that there is transfer from the lower skills to the higher skills. In other words, if the student possesses the lower skills he/she will be more likely to move through the sequence more quickly than a student who does not possess these skills.

A sequence may be positively validated by teaching some students a task in which the supposed lower skill is taught before the higher skill and teaching other students the sequence in reverse fashion. If the first group of students move through the sequence more quickly than the second, then the first sequence has been positively validated. For example, if a teacher suspects that there may be positive transfer if she teaches her students "greater than" before "less than" she may validate the sequence by teaching one group of students using the first sequence and a second group of students using the reverse sequence. If the first group require fewer average trials to criterion, the teacher has succeeded in positively validating the sequence "greater than", "less than" with her groups of students.

On the other hand, negative validation occurs if the students are unable to acquire higher skills until they have learned the lower skills. A sequence is negatively validated if it can be shown that the student will not acquire the higher skill until the lower skill is taught. Negative validation differs from positive validation in that in positive validation one sequence is more efficient than the other. In negative validation, the sequence will not be learned unless the lower skill is taught before the higher skill. For example, the teacher may investigate the effects of teaching "less than", "greater than" and "equal to" in all possible combinations of order with different groups of students. If she finds that the student will not learn "greater than" or "less than" until "equal to" has been learned, then the sequence "equal to" before "less than" or "greater than" has been negatively validated (White and Gagné, 1974).

Guess et al. (1978a) discussed a functional approach to sequencing curriculae for severely handicapped students. The authors were concerned that:

> ...there is much to be learned about 'how' to teach the severely handicapped. Nevertheless, our technology of 'how' to teach seems to be more advanced than our knowledge of 'what' skills to teach and the order in which these skills should be taught. (p. 202)

The approach to curriculum sequencing suggested by Guess et al. (1978a) was called the Functional Curriculum Sequencing Model (F.C.S.) The F.C.S. model combined two logics that are presently being used to sequence language curriculum content - the developmental logic and the remedial logic. These two logics will be discussed in detail in a following section.

The F.C.S. model sequences material in such a way that response generalization is more likely to occur. Items are sequenced in relation to a developmental/cognitive approach (items are sequenced in the order that "normal" children acquire the behaviors). However, the sequence is flexible in that only those skills thought to be environmentally functional for the children are taught. This allows the teacher flexibility in selecting behaviors that are functional for the children in their particular environment. Ultimately, the sequence to be used will be based upon data analysis.

The unique feature of this model for sequencing is that responses similar in topography and/or function are taught within behavioral classes. Transfer or generalization from one response is more likely to occur within that response class than to responses of a different response class.

The responses within a behavioral class may be in one curriculum area or may span several curriculum areas. For example, in the self-help domain, a child may be working on "pull pants down", "pull tissue from a box," "pull socks on", and "pull door open". Each of these responses are topographically similar in that they involve the response "grasp and pull". This example represents an instance of training responses that are topographically similar in a single domain. A second example might involve teaching a child to put on his shoes (self-help), teaching a child to label the object "shoe" (language), and teaching the child to group articles of clothing including a shoe (pre-academic). This example involves the development of a functional response class across domains.

Although this model of sequencing curriculum material for severely handicapped is impressive in principle, the entire model has yet to be validated in practice.

In summary, there is literature that points to a means of validating program sequences. The remainder of the review will focus upon the literature regarding how this information has been used to validate language program sequences.

Validation of Language Program Sequences

The lack of program validation is becoming particularly evident in the area of language programming (Price, 1979). In 1977, there were over 200 commercially available language programs on the market (Connell et al. 1977). According to Connell et al. (1977), many of these language programs did not provide adequate effectiveness information such as average trials to criterion and variance for program steps, description of clients who were used to obtain the data, and experimental analysis of generalization of the language behavior taught.

Given the great demand for language programs, is it feasible for the consumer to experimentally validate a language program sequence or compare one language program sequence to another language program sequence? The task analysis literature explains in detail how this may be accomplished (Borich, 1977; Gagné, 1974; Weber, 1977; White and Gagné, 1974). A particular language program sequence may be validated by testing the sequence on a large number of language deficient individuals and tabulating average trials to criterion and the range of scores for each step. Through data analysis the most efficient sequence may be determined.

Only one program could be found where the authors attempted to validate the language training sequence on a large scale using the method described above. This program is the Functional Speech and Language Training Program for The Severely Handicapped (Guess, Sailor and Baer, 1976). Data has been reported on the average trials to criterion and range of trials to criterion for 200 children on steps 1-9 of their program. In addition, mean trials to criterion were reported for fewer children from steps 10-35. Guess, Sailor and Baer (1978) attempted to positively validate parts of their language program sequence by reordering certain steps after data analysis.

Task analysis points to a method for validating and comparing language program sequences, but is this approach feasible? The task of validating an entire language sequence is formidible. The task of comparing two language sequences on a large scale may be impossible. For example, the Bricker, Ruder, and Vincent (1976) language sequence has 43 phases; the Guess et al. (1976) language sequence has 60 steps. Even if there was enough time, subjects, and money to accomplish the task of comparing language sequences, the following problems must be overcome:

1. the programs start at different levels of language development (i.e. they do not require the same prerequisite skills);
2. the programs teach different language skills;
3. the programs take the language-deficient person to a different level of language proficiency.

One may conclude that, at this point in time, language program validation must begin on a small scale studying either a few variations of a limited number of steps within one language program, or a few different sequences that propose to teach the same behavior between language programs.

At present, language programs are sequenced according to either a developmental logic or a remedial logic. Each of these logics are discussed below.

Developmental vs Remedial Logic Controversy

The issue of using developmental vs remedial logic to sequence language program content is very complex. The issue will be discussed briefly in this section since:

(a) both logics come to the same conclusion regarding the validation of program sequences, and;

(b) although much has been written about this issue from both extremes (Bowerman, 1978 - developmental logic; Guess et al. 1978b- remedial logic), little empirical data has been published comparing the relative merits of the two approaches (Guess et al, 1978b; Miller and Yoder, 1972; Ruder, 1978).

The developmental vs remedial logic issue will be discussed in the following format:

(1) a brief description of developmental logic;

(2) a brief description of remedial logic;

(3) implications for language program validation.

Developmental logic. A developmental logic to sequencing suggests that the best way to teach language to the language deficient child is to base the content and the sequence of content on the normal language development literature (Bloom and Lahey, 1978; Miller and Yoder, 1972; Ruder, 1978). This logic is based on the following two assumptions:

(i) language deficient children follow the same sequence of language development as normal children but the rate of acquisition is slower;

(ii) the normal developmental sequence is not an arbitrary sequence but moves from simple to more complex structures (Bricker et al. 1976).

The first assumption is straight forward and is certainly not new (Lenneberg, 1967). Using a developmental logic, it is assumed that all children (language deficient included) learn language in a similar sequence, but at different rates. Implicit in this assumption is that the language deficient will move more slowly through the sequence and will attain an overall lower level of language functioning, i.e. they will "peak" sooner (Lenneberg, 1967). There is presently a good deal of literature on the normal developmental sequence of language acquisition on which one could base instructional sequences (e.g. Brown, 1973; Folger and Leonard, 1978; Oviatt, 1980).

The second assumption made by developmental logic is more complex than the first. This assumption states that a certain level of cognitive development must be reached before the child can use various language forms. MacNamara (1972) states the above assumption in this way:

> (i) the child possesses non-linguistic cognitive processes before he learns their linguistic signal;
>
> (ii) children gradually develop many of the cognitive structures which they employ in association with language;
>
> (iii) the development of these cognitive structures precede the development of the corresponding linguistic structures. (p. 11)

Guess et al. (1978b) have stated this assumption in behavioral terms as follows:

> If language has a complex structure, such that parts of it depend for their function on other parts of it already mastered, then obviously the normal developmental sequence must represent at least one effective sequence of learning those interdependencies . (p.5)

If one examines a prerequisite stage of cognitive development in terms of linguistic and non-linguistic skills (e.g. sensori-motor skills) then task analysis points to a method for empirically validating language sequences based on a developmental logic. White and Gagné's (1974) methods of positive and negative validation of learning hierarchies could be used to determine if the normal developmental language sequence was comprised of a series of prerequisite skills that must be attained in a particular order for efficient language learning.

A few of the more prominent language programs that use the developmental logic as a basis for their sequences are Miller and Yoder (1974), Bricker and Bricker (1974), Stremel and Waryas (1974).

Remedial logic. Remedial logic does not turn to normal language development for information on program sequencing. Instead, remedial logic sequences program content such that the order in which language is taught will accomplish some improvement in the child's functional language most quickly. The definition of functional language will differ from child to child and will depend upon his/her particular environment. Remedial logic explicitly states that the sequence of training content must remain flexible in accordance with ongoing data analysis. If data shows that training one item in the sequence facilitates the training of a second item, then the sequence will not be changed. However, if the opposite results were obtained, the sequence would be altered to reflect the data analysis.

Guess et al. (1978b) stated the remedial logic as follows:

> Remedial logic, then, will not ask in what order the retarded child needs to learn language, but rather in what order the language taught most quickly will accomplish some improvement in the child's communication. (p. 6)

Remedial logic is based on the following assumptions:

(i) There are alternate sequences for teaching language other than the normal developmental sequence;

(ii) The normal language sequence may no longer be appropriate to an individual learning language later in life. (Guess et al. (1978b) state this issue as follows:

> The usual recipient of systematic, experimental language training will be a retarded child, well past the second-year level of motor development, possessed of a certain deviant means of interacting with peers and adults and securing some service from them, and with some acquaintance with the physical ecology of the world and its mechanics--all deficient, all oddly sorted and conditioned by years of institutional life or the sheltering that a home-based retardate receives, but none of it any longer representative of the concatenation of knowledge and ignorance, ability and inability of the 18 month old normal child. (p. 6)

(iii) Productive language should predominate receptive language. Remedial logic assumes that although both productive (expressive language) and receptive language are important, productive use of any form should be taught before receptive training on that form so that the language-deficient individual has more control over his/her environment.

The remedial logic assumes that production (trained through imitation) and comprehension are separate skills and therefore they may be trained separately (Guess, 1969; Guess and Baer, 1973; Lee, 1978). Developmental logic, on the other hand, assumes that comprehension proceeds production and should be taught first (Vasta, Andrews, Griffin, and Kwiatkowski, 1978).

Two prominent programs that reflect the remedial logic are Guess et al. (1976) and Gray and Ryan (1973).

Implications for Language Program Validation. Spradlin (1974) made the following statement regarding the language programs sequencing controversy:

> A colleague of mine has stated that the issue of what can be trained in what order is not the critical question. He suggests that the critical issue for training is 'whether it is more efficient to teach certain language structure prior to others?' His implied answer is that some sequences of training must be better than others. Perhaps the determination of such sequences is a fruitful direction for language training research. (p. 280)

The developmental-remedial logic controversy will be resolved only through well documented research studies. It will not be resolved through theoretical discussions expounding one extreme or the other. Although the two logics were stated in terms of their differences, the logics agree on two important issues:

(i) The language training sequence should concentrate on teaching language that is functional for the language deficient individual. Guess et al. (1978a) defined a functional response as one that:

(1) produced an immediate consequence for the child;
(2) is reinforcing; and
(3) combined with the consequence, is natural to the child's interaction with the environment.

(ii) Language sequences should be empirically validated whether they originate in the normal developmental literature or in a remedial rationale (Bowerman, 1978; Guess et al, 1978a; Ruder, 1978).

The second issue is of major importance for the present study. Three studies could be found that addressed the issue of language program sequence validation in areas not related to the focus of this study.

The first study investigated the subject-verb-object training sequence in a language training program (Ruder, 1978). Literature on the normal developmental language sequence suggests that normal children acquire two-word structures (verb-object, subject-verb, subject-object) before acquiring the three-word structure subject-verb-object.

In order to determine whether language-deficient retarded children had to be trained on all three two-word structures before learning the three-word structure, Ruder (1978) omitted one of the structures from the training on all three structures. It was found that, after comparing trials to criterion for the three-word structure, not only was the subject-object structure not necessary for acquiring the three-word structure, but training on the subject-object structure resulted in significantly more trials to criterion for the three word structure. This study would support the assumption made by remedial logic that the normal developmental sequence may not always be the most appropriate sequence to use when teaching the language deficient child. The subject-verb-object sequence was positively validated (White and Gagné, 1974) through data analysis.

A second study which looked at training sequences, described the use of a sensitizing quotient to objectively evaluate training sequence (Ruder, 1978). A sensitizing quotient is obtained by training one group using a particular sequence of two training items, then training the two items in the reverse order with a second group. The ratio of (1) the number of trials to criterion for an item when it is trained second in the sequence to (2) the number of trials to criterion when the item is trained first in the sequence yields a probability index. This index refers to the probability that the non-trained behavior will or will not occur as a function of the trained behavior. The probability index (or sensitizing quotient) may be compared for both items in the sequence. A sensitizing quotient of 1.0 or greater indicates that it took the same number of trials or more trials when one item was trained second in the sequence as when it was trained first. A sensitizing quotient of less than 1.0 indicates some interdependence between the two items. The closer the sensitizing quotient is to 0.0, the greater the interdependence between the two items.

For example, Stremel (1973) taught one group of children the copula "to be" before the auxiliary "to be". A second group received training in the reverse order. The ratio of subsequent to initial training trials for the copula was 11.9/13.8 yielding a sensitizing quotient of .86. The sensitizing quotient for auxilliary training was .54, indicating interdependence between the two linguistic behaviors. There was greater interdependence for auxilliary training, therefore, Stremel (1973) concluded that the copula should be trained before the auxilliary. These findings are consistent with the order of acquisition of normal children.

A third study by Leonard (1975) investigated the effects of teaching the negative "don't" and the auxiliary "is" in a developmental vs a non-developmental (additive) sequence. For example, the developmental sequence for "don't" was (1) "no play"; (2) "they no play"; (3) "they don't play". The additive sequence for "don't" was (1) "don't"; (2) "don't play"; (3) "they don't play." Results indicated that the children required fewer trials to criterion with the developmental sequence. In this instance, a developmental sequence was superior to a non-developmental sequence, however, other non-developmental sequences may have been used as a comparison with different results.

In summary, both the developmental and remedial logic agree that language program sequences must be validated through data analysis. The previous discussion outlined initial attempts at language program sequence valuation.

Validation of a Specific Language Program Sequence

The present study was concerned with the validation of a teaching sequence involving imitation and comprehension training. Literature relating to the sequencing of imitation and comprehension training is discussed in two sections. The first section deals with literature on production and comprehension training. The second section discusses literature on imitation and comprehension training.

Production and Comprehension.

The production/comprehension literature was examined since:

(1) production often involved some imitation training;

(2) imitation and production are both forms of expressive language.

In general, the production/comprehension language studies were interested in the effect of auditory comprehension training on verbal production and the effect of verbal production training on auditory comprehension. The facilitating effect of training in one modality (auditory or verbal) on the alternate modality has been referred to as "cross-modal transfer"(Keller and Bucher, 1979).

Guess (1969) taught the plural morpheme in comprehension to two severely retarded adolescents. The two subjects failed to generalize to the alternate modality when they were tested on production probes. Guess and Baer (1973) taught two different pluralization rules (one in comprehension and one in production) and probed the untrained modalities. Three of the four severely retarded subjects failed to show generalization to the untrained modality. The authors concluded that language training should be conducted in both modalities since unprogrammed generalization from one modality to the other did not occur spontaneously.

More recent literature indicates that training in one modality does facilitate performance in the untrained modality. Cuvo and Riva (1980) suggested that the direction of transfer (from comprehension to production; or production to comprehension) may be dependent upon the population studied. Studies with normal subjects show that prior comprehension training facilitates later production performances. Asher (1972) and Winitz and Reeds (1972) found that comprehension training alone resulted in accurate verbal production when teaching a second language to college students. Mann and Baer (1971) found that comprehension training with preschoolers on a mixture of nonsense words and real words resulted in better articulation on trained words vs untrained words during production probes. Vasta, et al. (1978) obtained the same result with normal Grade 1 and Grade 2 students. Studies with handicapped individuals indicated a facilitation effect in the opposite direction - from production to comprehension. Miller, Cuvo and Borakove (1977) taught coin value to mentally retarded adolescents. Miller et al. (1977) found that prior comprehension training on coin values did not facilitate production acquisition. Training on production alone resulted in complete transfer to comprehension without direct training. Keller and Bucher (1979) taught noun labels to moderately/

severely retarded children in one modality while probing in the opposite modality. They found that there was limited transfer to production probes when comprehension was trained. On the other hand, production training resulted in almost perfect transfer to comprehension probes.

Cuvo and Riva (1980) studied the possibility that the direction of the transfer between comprehension and production may be as a result of the population studies. Cuvo and Riva (1980) compared cross modal transfer with retarded and non-retarded subjects. They found transfer in both directions (production to comprehension and comprehension to production) for both retarded and non-retarded subjects. Cuvo and Riva (1980) concluded that the direction of transfer was not different for handicapped and non-handicapped groups. The authors suggested that transfer may occur in only one direction for more difficult tasks and in both directions for easier tasks.

Imitation and Comprehension. There is literature to support both the "imitation and then comprehension" (IM/COMP) sequence and the "comprehension and then imitation" (COMP/IM) sequence.

(1) Imitation/Comprehension - Fraser, Bellugi and Brown (1963) presented three year old children with a test of imitation, comprehension, and production. The children were presented with pairs of pictures portraying 10 different grammatical relationships (e.g. subject and object relationships - "the girl pushes the boy" vs "the boy pushes the girl"). In the comprehension task the child was asked to point to one of the two pictures. In the production task the child was asked to describe the picture that the experimenter pointed to. During imitation, the pictures were removed and the child was asked to imitate the sentences. The order of presentation of imitation comprehension and production was

randomized across the 12 children. Results indicated that the children made more correct responses in imitation than in comprehension; and more correct responses in comprehension than production. The authors concluded that imitation was more advanced than comprehension and comprehension was more advanced than production in the normal 3 year old child.

Fernald (1972) challenged the results obtained by Fraser et al. (1963) stating that the scoring procedure used by Fraser et al. (1963) was biased in favor of the comprehension task. After the data reported by Fraser et al. (1963) was corrected for this bias, the results indicated more correct responses for the production task than the comprehension task. In addition, Fernald (1972) replicated the Fraser et al. (1963) study computing the data with and without scoring bias. As was expected, when the data analysis included the bias, the comprehension task had more correct responses than the production task. When the data was analyzed without the bias, there were no significant differences between the comprehension and production task. Thus, there is some ambiguity in the literature regarding the Imitation/Comprehension/Production sequence.

(2) Comprehension/Imitation - Whitehurst (1977) stated that acquisition of particular linguistic forms proceeds in the sequence comprehension-selective imitation-production (CIP Hypothesis). Selective imitation refers to the fact that the:

> ...child may match a portion of the grammar of an adult utterance without imitating all of the utterance. (p. 23)

Briefly, the CIP Hypothesis states that differential reinforcement is an important variable in the development of comprehension. The child will selectively imitate particular characteristics of adult speech that have been differentially reinforced. To restate the hypothesis, the child learns to discriminate particular relations of adult speech (comprehension), then selectively imitates these relations, then begins to spontaneously produce these relations.

Recent research supports this hypothesis (Asher, 1972; Mann and Baer, 1971; Ruder, Smith and Hermann, 1974; Ruder, Hermann and Schiefelbusch, 1977; Whitehurst, 1977). The studies mentioned above all suggest that comprehension training should precede imitation or production training. The position is also consistent with a developmental logic.

The last two studies to be discussed in this section are central to the focus of this research. Ruder, Smith and Hermann (1974) assessed the effects of comprehension and imitation training on production probes with three normal preschool children. Each child was taught two words in comprehension alone; two words in imitation, then comprehension; and two words in comprehension, then imitation. Words trained in the sequence comprehension then imitation resulted in 100% accuracy on the production probes sooner than the other two sequences. Ruder et al, (1974) concluded that it doesn't really matter whether imitation training precedes comprehension or comprehension precedes imitation. Both of these elements are required before word production is achieved.

A second study by Ruder et al. (1977) was conducted to determine if the same results would be obtained with older children (6-8 year olds). Ruder et al. (1977) studied the effect of order of introduction of imitation training and comprehension training on production (labelling) skills. Normal children were taught Spanish nouns in two instructional conditions. In one condition, the children were first taught to imitate the Spanish noun without a referent object present. These children were then taught to point to the Spanish word representing the noun with seven distractors present. At regular intervals during the imitation and comprehension task, the children were probed on labelling of the Spanish nouns (they were asked "What's that?" for each of the Spanish nouns). In the second condition, the children were taught another set of Spanish nouns with imitation and comprehension reversed in order. Both conditions were carried out concurrently.

The initial introduction of imitation or comprehension was counter-balanced across the children. Ruder et al. (1977) found that when comprehension training preceded imitation training, the child reached criterion on production probes more quickly than if the sequence was reversed. In addition they concluded that initial imitation training interfered with subsequent comprehension training, since comprehension required more trials to criterion when it was trained after imitation rather than prior to imitation. In the discussion the authors suggested that a language program that taught imitation, then comprehension of lexical items may not be the most efficient sequence to use given the results of this study. This study constituted a positive validation of the training sequence - comprehension then imitation.

In conclusion, the production/comprehension literature suggests that training in one modality may facilitate performance in the untrained modality. The imitation/comprehension literature is equivocal on the most efficient sequence to teach imitation and comprehension training, although more recent studies favor the "comprehension then imitation" (COMP/IM) sequence.

Sequential vs Simultaneous Presentation.

Three studies investigated the effects of simultaneous vs sequentially presentation of training items (Cuvo et al. 1980; Panyon and Hall, 1978; Shroeder and Baer, 1972).

Shroeder and Baer (1972) found no difference in overall trials to criterion when verbal imitation items were trained simultaneously vs sequentially with two retarded females; however, simultaneous training resulted in superior performance on generalization tests. Panyon and Hall (1978) extended this investigation to an inter-task level. They taught two tasks (tracing and vocal imitation) sequentially, then concurrently with two retarded subjects. Results indicated that there was no difference in overall trials to criterion or maintenance, however, as with Shroeder and Baer (1972), concurrent training resulted in greater generalization. Both studies investigated generalization to untaught probe items.

Cuvo et al. (1980) compared three different strategies to teach Hebrew letters to college students, English words to mentally retarded adolescents, and American coins to normal preschoolers. Presentation method was a between-subjects factorial design. The three conditions involved simultaneous training of items, sequential training, and a combination sequential/simultaneous training condition. The sequential condition resulted in fewer trials to criterion, however, the difference in training time only amounted to a matter of a few minutes. Retention tests given immediately after training favored the simultaneous and combination conditions over the sequential condition. The authors suggested that from a cost-effectiveness point of view, their data favored the simultaneous or combination procedures for teaching verbal naming skills over the sequential condition.

In conclusion, the results of studies by Shroeder and Baer (1972); Panyon and Hall (1978); and Cuvo et al. (1980) favor simultaneous item or task presentation over sequential presentation.

Summary

The literature review was concerned with literature on program validation. Of particular concern was literature dealing with language program validation. The present study focused on a particular language training sequence involving imitation and comprehension training. A review of the literature dealing with imitation, comprehension and production training indicated that:

(1) training in one modality (auditory or verbal) may facilitate performance in the untrained modality;

(2) there is literature to support an "imitation then comprehension (IM/COMP) training sequence as well as a "comprehension then imitation (COMP/IM) training sequence, and

(3) simultaneous presentation of learning items may result in greater generalization and greater short term retention than sequential presentation.

CHAPTER III

RATIONALE

The literature suggests that language program sequences should be validated (Connel et al. 1977; Cuvo and Riva, 1980; Guess et al. 1978a; Ruder, 1978) and one way to validate these sequences is through positive or negative validation (White and Gagne, 1974). A sequence has been positively validated if students move more quickly through that particular sequence of skills than the reverse sequence. A sequence has been negatively validated if students learn a particular sequence of skills, but are not able to learn the skills in the reverse sequence (the sequence is not learned unless the lower level skills is taught before the higher level skill).

The present study was concerned with the positive validation of two sequences of imitation and comprehension training, and the effect of the two sequences on verbal production. Imitation, comprehension, and production have been defined as follows:

(1) Imitation - is defined as the child matching in sequence two or more phonemes of the stimulus word modelled by the teacher within five seconds of the instruction "Say _____". The teacher will hold up the referent object at eye level during the instruction.

(2) Comprehension - is defined as the child pointing to or touching an object labelled by the teacher

within five seconds of the instruction "Show_____."
Three distractor items plus the stimulus item will be present when the instruction is given.

(3) Production - is defined as the child matching in sequence two or more phonemes of the word corresponding to the referent object within five seconds of the teacher holding up the referent object and asking "What's that?"

Approximations to correct responses were accepted in the imitation and production instructional components. For the purposes of this study, an approximation was defined as the verbalization of two or more phonemes (in order) present in the verbal label for an object. The approximation had to occur within seconds of the question "What's that?" or the teacher's instruction "Say (object name)."

Approximations were accepted as correct responses in the imitation and production instructional components because of the age of the children in this study. Non-handicapped children below eight years of age are not expected to produce all speech sounds therefore it was highly unlikely that young retarded children would produce all speech sounds necessary to imitate or produce the nouns in the present study.

The major focus of this study was a positive validation of two alternate teaching sequences involving imitation and comprehension training. One teaching sequence involved imitation training followed by comprehension training (IM/COMP condition). The alternate sequence involved comprehension training followed by imitation training (COMP/IM condition). Those supporting a remedial logic would favor the IM/COMP sequence since expressive training (imitation) preceded receptive training (comprehension), Guess et al. (1978b). On the other hand, developmental logic would support the alternate sequence - COMP/IM since comprehension training preceded the expressive training (Nietupski and Hamre-Nietupski, 1979). The ambiguity in the literature regarding the best sequence for imitation and comprehension training prompted the present investigation of the IM/COMP vs COMP/IM sequences.

A second concern of the present study was the effect of presenting imitation and comprehension training sequentially (IM/COMP and/or COMP/IM) versus simultaneously (SIM). IM/COMP and COMP/IM involved the sequencial presentation of imitation and comprehension training. The third condition (SIM) involved simultaneous presentation of imitation and comprehension training. Shroeder and Baer (1972), Panyon and Hall (1978) and Cuvo et al. (1980) have suggested that simultaneous presentation results in better generalization and retention than sequential presentation.

A final concern was the effect of the order of imitation and comprehension training on the acquisition of production probes and/or the acquisition of production training items.

The present study replicated, with modifications, the Ruder et al. (1977) study investigating the effects of two sequences of imitation and comprehension training on production probes. Modifications made to the original Ruder et al. study included the following:

(1) The conditions in the Ruder et al. study were taught simultaneously. In the discussion, Ruder et al. (1977) suggested the possibility that since imitation of one set of words was proceeding at the same time as comprehension of a second set of words, there may have been some transfer from one set to the other when imitation and comprehension were reversed. In this investigation the conditions were taught in a sequential order as well as simultaneous order.

(2) The task in Ruder et al. (1977) involved imitation and comprehension training on Spanish nouns (four per subject in each condition). The children in this study were taught imitation and comprehension of English nouns (four per subject in each condition).

(3) The subjects in Ruder et al. (1977) were 51 six - eight year old normal children. Subjects in this study were six, two and one-half - five year old language deficient children.

(4) Ruder et al. (1977) did not report maintenance data. Maintenance data in this study was collected up to five weeks after a child reached criterion on an item.

(5) Ruder et al. (1977) did not directly train production as the children were able to reach criterion on the production probes without direct training. It was

anticipated that the children in this study might not reach criterion on all of the production probes. For this reason, production training followed imitation and comprehension training on any items that the child failed to acquire during production probes (three consecutive correct responses on a probe).

(6) Ruder et al. (1977) did not do an error analysis on words reaching criterion even though less-than-perfect productions were accepted. It was possible that one sequence resulted in more accurate production than the other sequence. This study conducted an error analysis on words reaching criterion, in order to investigate this point.

(7) Ruder et al. (1977) conducted imitation training without a referential object present. A referential object was included in the present investigation during imitation training since data indicated that this was the most efficient way to teach imitation (Carpenter, 1976).

(8) Ruder et al. (1977) "discouraged" subjects from imitating or producing words during the comprehension training. In this study, the subjects were not discouraged from verbalizing during comprehension, however, all such verbalizations were recorded for further analysis.

The present study investigated the effect of three conditions involving imitation and comprehension training. The IM/COMP condition trained imitation prior to comprehension. The COMP/IM condition trained the reverse sequence. Both the IM/COMP and COMP/IM conditions involved sequential training. The third condition (SIM) involved the simultaneous training of imitation and comprehension. Five hypotheses have been formulated and each of these are discussed in detail below.

Hypothesis #1 - Training comprehension before imitation (COMP/IM) will result in fewer total sessions to criterion for imitation and comprehension training and a greater savings in instructional time than training the alternate sequence.

Studies by Ruder et al. (1977), Whitehurst and Vasta (1975), and Whitehurst (1977) support Hypothesis #1. The Hypothesis is not supported by Fraser et al. (1963) and Fernald (1972).

Research Supporting Hypothesis #1 - Whitehurst and Vasta (1975) and Whitehurst (1977) concluded that the acquisition of a particular linguistic form proceeds in the sequence - comprehension, then selective imitation, then production (CIP Hypothesis). Whitehurst (1977) found that non-handicapped preschoolers achieved production on normal and reversed order direct and indirect objects only after comprehension training occurred.

It is interesting to note that although the Whitehurst (1977) study was taken as support of a CIP Hypothesis, the study did not include imitation training as it is defined in the present research. Initial training for the children in the Whitehurst (1977) study was a modelling procedure. The children were shown pictures of direct-indirect object relationships and the experimenter modelled a verbal response to the picture. The verbal response either described the relationship accurately (e.g. "The tiger shows the dog to the bear"), or modelled an incorrect response to the picture (e.g. "The tiger shows the bear to the dog"). Children were not allowed to imitate during the modelling procedure. During production trials the experimenter asked the child to tell him/her about the picture. Production was later described by Whitehurst as "elicited imitation." The results of this study indicated that children made correct responses during production probes when the experimenter modelled an accurate description of the picture. Children did not model inaccurate descriptions of the pictures unless prior comprehension training on reversed direct-indirect object relationships was administered.

Although the study by Whitehurst (1977) is taken as support for the training sequence COMP/IM, there are problems with the study:

(1) modelling and not imitation training preceded comprehension;

(2) comprehension was not trained without prior modelling trials;

(3) the children did move directly from modelling to accurate production when the direct-indirect object relationship was modelled in the appropriate sequence.

Ruder (1977) would also support the COMP/IM condition and Hypothesis #1. In an earlier study with non-handicapped preschoolers Ruder et al. (1974) found that training in one instructional procedure (imitation or comprehension) facilitated subsequent training in the other instructional procedure (the second instructional procedure required fewer trials to criterion than the first). Both imitation and comprehension training were required before criterion was met on production probes. Ruder et al. (1977) modified conclusions from the previous study (Ruder et al. (1974)). Ruder et al. (1977) found that comprehension training with non-handicapped 6 - 8 year olds required more trials to reach a similar level of proficiency when it followed imitation training than when it preceded imitation training. The authors concluded that teaching imitation first interferred with the acquisition of subsequent comprehension.

In conclusion, Ruder et al. (1977), Whitehurst and Vasta (1975), and Whitehurst (1977) would support Hypothesis #1 and the COMP/IM training sequence.

Conflicting Literature - Fraser et al. (1963) found that non-handicapped preschoolers tested on imitation, comprehension and production of 10 different grammatical relationships made more correct responses in imitation than in comprehension, and more correct responses in comprehension than in production. A developmental logic would suggest that, if this sequence is the normal developmental sequence, the optimal training sequence would presumably be imitation, then comprehension, then production (IM/COMP). A remedial logic would support this sequence since the expressive mode (imitation) is trained before the receptive mode.

Fernald (1972) challenged the results of the Fraser et al. (1963) study on the basis of a scoring bias. Analysis of the data by Fernald without the scoring bias resulted in no significant difference between the comprehension and production tasks. Fernald (1972) did not, however, challenge the finding that imitation performance exceeded comprehension performance. For this reason, the Fernald (1972) replication of the Fraser et al. (1963) study is judged to be in agreement with that study on the superior performance during the imitation test when compared with performance during the comprehension test. If this interpretation is accurate, then both studies would support the IM/COMP condition rather than the COMP/IM condition.

Comprehension/Production Studies - The studies investigating comprehension and production (but not examining imitation) are relevant to Hypothesis #1 since:

(1) production often involved some imitation training;

(2) imitation and production are both forms of expressive language.

Guess (1963) and Guess and Baer (1973) found that expressive language (production) and receptive language (comprehension) were two separate processes. Training in one modality did not affect performance in the untrained modality. Other literature to date does not support this finding (Asher, 1972; Cuvo and Riva, 1980; Holdgrafer, 1975; Kohl et al. 1979; Keller and Bucher, 1979; Mann and Baer, 1971; Miller et al. 1977; Ruder et al. 1974; Ruder et al. 1977; Vasta et al. 1978; Whitehurst, 1977; Winitz and Reeds, 1972). These studies found that facilitation did occur:

(a) from comprehension training to production performance (Asher, 1972; Kohn et al. 1978; Mann and Baer, 1971; Vasta, et al. 1978; Winitz and Reeds, 1972);

(b) from production to comprehension performance (Keller and Bucher, 1979: Miller et al. 1977) and

(c) in both directions (Cuvo and Riva 1980).

The literature suggesting that prior comprehension training affects performance in production is taken as support for Hypothesis #1 and the COMP/IM training sequence. The literature suggesting facilitation from production to comprehension would not support Hypothesis #1 as it would favor the IM/COMP training sequence.

The study by Cuvo and Riva (1980) suggesting that prior comprehension training affects production and vice versa would not support Hypothesis #1. Although facilitation occurred in both directions, Cuvo and Riva (1980) concluded that the best sequence in which to teach language would be production training followed by comprehension training. Initial production training resulted in almost perfect transfer to comprehension without specific training in comprehension. The transfer from comprehension to production was not nearly as dramatic. Cuvo and Riva (1980) would support an IM/COMP training sequence.

In summary, there is literature to support Hypothesis #1, however, a number of studies present evidence to the contrary.

Hypothesis #2. This hypothesis has been divided into two sections -- A and B. Both sections deal with production performance.

Hypothesis #2A - Criterion will be reached on production probes only after both imitation and comprehension training have occurred.

Studies with normal adults (Asher, 1972; Winitiz and Reeds, 1972) found that comprehension training alone was sufficient to bring about verbal production. In contrast, Ruder et al. (1974, 1977) found that both comprehension and imitation training were necessary before verbal production occurred consistently. Ruder et al. (1974) hypothesized that the results obtained by Asher (1972) and Winitz and Reeds (1972) may have been affected by covert and/or overt imitation during comprehension training. In both Ruder et al. studies, the children were specifically instructed not to imitate during comprehension training. This did not rule out the possibility of covert imitation during comprehension training.

Ruder et al. (1974) and Ruder et al. (1977) would support Hypothesis #2A. Asher (1972) and Winitz and Reeds (1972) would not support this hypothesis.

Hypothesis #2B - Training comprehension before imitation (COMP/IM) will result in:

(1) a greater percentage of production probes reaching criterion: and

(2) a greater percentage of words trained in production reaching criterion within five sessions than the alternate sequence (IM/COMP).

Ruder et al. (1977) found that prior comprehension training

(COMP/IM sequence) resulted in earlier acquisition of production probes (often after the first session in imitation) when compared with training in the alternate sequence (IM/COMP). In addition, prior comprehension training (COMP/IM) resulted in more stable performance on production probes than the alternate sequence (IM/COMP). These results would support Hypothesis #2B.

Asher (1972) and Winitz and Reeds (1972) would also support Hypothesis #2B. Both studies found that non-handicapped college students acquired production after training in comprehension (i.e. imitation training was not required). The results of these studies would predict that the children in the present research could reach criterion on production probes in the COMP/IM condition during the comprehension training component. If this occurred, imitation training would not be necessary.

In conclusion, Ruder et al. (1974) and Ruder et al. (1977) support Hypothesis #2A and 2B. Asher (1972) and Winitz and Reeds (1972) lend support for Hypothesis #2B, but not #2A.

Hypothesis #3. The order of imitation and comprehension training (IM/COMP, COMP/IM, or SIM) will not affect follow-up results. Three studies could be found that examined production/comprehension and reported follow-up data (Cuvo and Riva, 1980; Cuvo et al. 1980; and Miller et al. 1977). Studies examining comprehension and imitation training did not report follow-up data.

Cuvo and Riva (1980) and Miller et al. (1977) both reported follow-up data after one week and after four weeks. Both studies reported a high level of maintenance over the four weeks (the exact level of performance was not specified) regardless of whether production was trained with comprehension probes or comprehension was trained with production probes.

Cuvo et al. (1980) found that subjects scored higher on retention tests conducted immediately following training when items were trained simultaneously vs sequentially. A third condition which combined simultaneous and sequential presentation also resulted in superior performance on the retention tests when compared with the sequential presentation. The authors suggested the possibility that the simultaneous and combined conditions could result in superior performance on long term follow-up (after 1 and 4 weeks); therefore this study would not support Hypothesis #3.

In conclusion, Cuvo and Riva (1980) and Miller et al. (1977) support Hypothesis #3. Cuvo et al. (1980) would favor increased maintenance for the SIM condition, therefore, this study would not support Hypothesis #3.

Hypothesis #4. Simultaneous presentation of imitation and comprehension training (SIM) will result in increased generalization performance (higher percent correct responses) than sequential presentation of imitation and comprehension (IM/COMP and COMP/IM).

Two of the studies reviewed found that simultaneous presentation resulted in better generalization performance than sequential presentation. Shroeder and Baer (1972) reported no significant difference in trials to criterion when one item was trained simultaneously with another item vs sequentially. Shroeder and Baer (1972) did find better generalization to untrained probes with simultaneous presentation of teaching trials. Panyon and Hall (1978) taught two tasks simultaneously and sequentially. They also found no significant difference in trials to criterion but superior generalization to untrained probes for the simultaneous presentation of tasks.

The present study examined generalization to an object with different stimulus dimensions than the original object used in training, generalization to a different setting, and generalization to a different teacher. It was hypothesized that the SIM condition would result in a greater percentage of trained items showing generalization to a different object, setting, and teacher, than the IM/COMP and COMP/IM conditions.

Shoreder and Baer (1972) and Panyon and Hall (1978) were considered to support Hypothesis #4. No conflicting research could be found.

Hypothesis #5. Comprehension training preceding imitation training (COMP/IM) will result in a smaller percentage of articulation errors (determined through error analysis) for criterion words in imitation.

Asher (1972); Mann and Baer (1971); Winitz and Reeds (1972) and Vasta et al. (1978) found that prior comprehension training resulted in more accurate imitation of words. When the subjects were given prior comprehension training on some verbal items, they exhibited more accurate imitation of these items than matched probe items that did not receive prior comprehension training. It was hypothesized that the children in the present study would have fewer articulation errors on criterion words in imitation if comprehension training preceded imitation training (COMP/IM) rather than followed imitation training (IM/COMP).

In conclusion, Asher (1972); Vasta et al. (1978) and Winitz and Reeds (1972) support Hypothesis #5.

Summary. This study investigated the effects of three conditions involving imitation and comprehension training. Two conditions (IM/COMP and COMP/IM) involved sequential training and one condition (SIM) involved simultaneous training. The results of the present study have been summarized and discussed in terms of five hypotheses. This chapter provided a discussion of supporting and contradictory literature relating to the five hypotheses.

CHAPTER IV

METHOD

Subjects

Six developmentally delayed children between the ages of three and five served as subjects. Demographic data for these children appears in Table 1. Five of the children had Down's Syndrome and the sixth child was diagnosed as Fetal Alcohol Syndrome. Three of the children resided at home with their natural parents, while the remaining three resided in an institution and/or foster home setting. The average age of the children was 3 years 10 months at the beginning of their involvement in the study.

Insert Table 1 about here

All of the children in this study attended an early education program at Mayfield Elementary School in Edmonton five half-days per week during the school term. Children attending this program worked on skills in the developmental areas of self-help, cognition, motor, socialization, and language. In the area of language, all children in this study had learned to imitate gestures, sounds, and a minimum of two words in individual language sessions (Kysela, Hillyard, McDonald and Ahlsten-Taylor, 1980). In addition to the above skills, the children had been taught to sit quietly at a table or desk and attend to an "attending signal" (Becker, Engelmann, and Thomas, 1975).

Table 1

Demographic Data

Subject	Age on Entering Study	Diagnosis	Other Related Problems	Residence	Date Of Entry Into Early Education Program	Other Programs
S_1 (M)	3	Down's Syndrome	Heart Disorder	Home	Sept. 1975*	None
S_2 (F)	4	Down's Syndrome	Heart Disorder	Institution & Foster Home	Jan. 1976*	None
S_3 (F)	3.5	Down's Syndrome	Heart Disorder	Home	Jan. 1976*	None
S_4 (M)	5	Down's Syndrome	Heart Disorder, respiratory, visual orthopedic disorders, seizures	Institution & Foster Home	Jan. 1976	None
S_5 (F)	4	Down's Syndrome	Heart Disorder	Home	Sept. 1979	Peter Pan Nursery (Toronto)
S_6 (F)	3.5	Fetal Alcohol Syndrome	None recorded	Institution	Sept. 1979	None

*These children attended a home-based program prior to entering the school-based program at Mayfield Elementary School.

Children were selected for this study if they demonstrated the following characteristics:

(a) chronological age did not exceed six years;

(b) they attended to a teacher in a 1:1 setting;

(c) they imitated a minimum of two words;

(d) given a four-choice discrimination task, they would point to or touch a minimum of two different objects on instruction "Show_____";

(e) they did not spontaneously produce nouns at school.

For a description of the pretest used to select the subjects for this study, refer to Appendix A.

Setting.

Individual language sessions were conducted in an area enclosed on three sides by a wall and room dividers. The fourth side, which faced away from the other children in the room, remained open so that sessions could be monitored for inter-observer reliability checks. Dimensions of the area were approximately 1.3m by 1.3m.

The child sat on an adult-size straight-back chair facing the teacher. The teacher sat on a child-size chair directly opposite the child so that both the teacher and the child were on approximately the same eye level. Primary reinforcers (raisons, small pieces of cookie, juice) and data sheets were located on a small table to the teacher's right. Objects used during training were kept in the teacher's lap prior to a trial and in a box out of the child's sight when not in use.

During imitation and production training, the teacher removed an object from her lap and held it beside her face at the child's eye level during a trial. Following a trial the object was returned to her lap. During comprehension training, the four objects used during a trial were arranged on a stimulus board constructed for the purpose of this study. The dimensions of the stimulus board were 31 cm by 79 cm. Pieces of wooden dowelling were glued to the surface of the board to make four 20 cm x 20 cm squares approximately 5 cm apart. The stimulus board kept the objects equi-distant from each other and prevented the objects from rolling. Following a trial, the teacher removed all four objects, shuffled them on her lap and returned them to the stimulus board in a different position. The teachers were requested to change the position of the items on a random basis for each comprehension trial.

Teachers recorded session duration using a conventional stop-watch.

Generalization tests with a different object and a different teacher were conducted in the language program area as described above. Generalization to a different setting was tested at the front of the classroom in the "free play" area.

Procedure

Experimental Conditions. There were three experimental conditions in this study (See Table 2). The first two conditions

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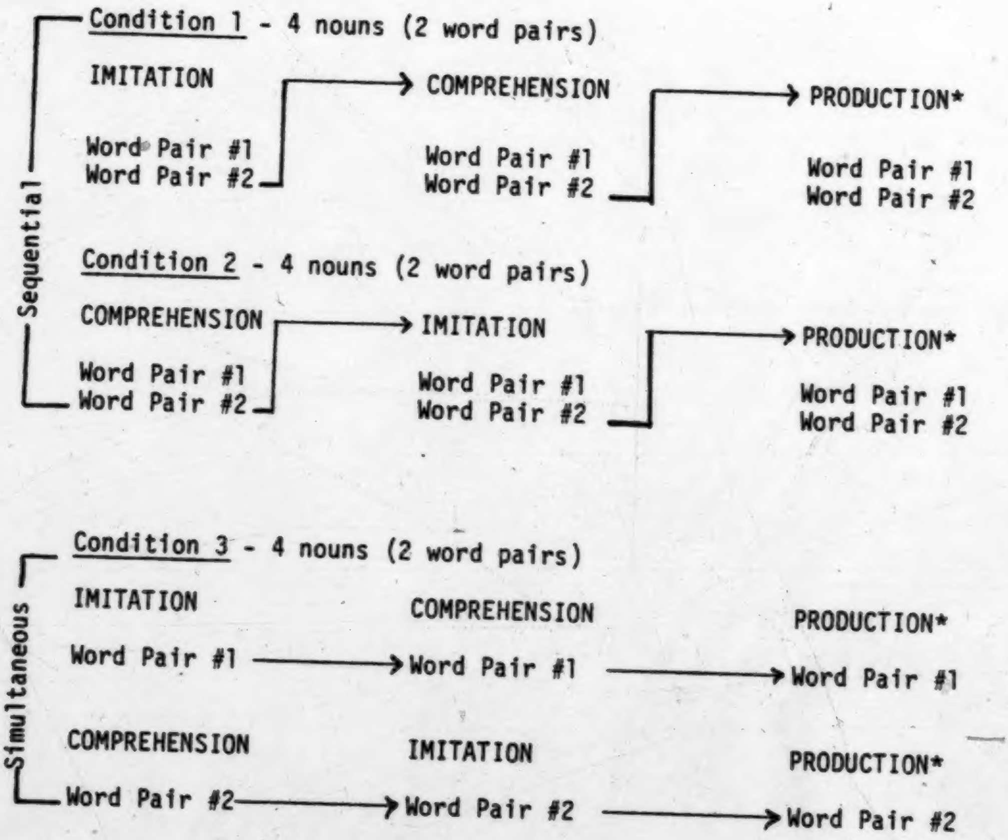
Insert Table 2 about here

Table 2

Experimental Conditions


Sequential
Condition 1 - 4 nouns (2 word pairs)
IMITATION
Word Pair #1
Word Pair #2
COMPREHENSION
Word Pair #1
Word Pair #2
PRODUCTION*
Word Pair #1
Word Pair #2
Condition 2 - 4 nouns (2 word pairs)
COMPREHENSION
Word Pair #1
Word Pair #2
IMITATION
Word Pair #1
Word Pair #2
PRODUCTION*
Word Pair #1
Word Pair #2
Simultaneous
Condition 3 - 4 nouns (2 word pairs)
IMITATION
Word Pair #1
COMPREHENSION
Word Pair #1
PRODUCTION*
Word Pair #1
COMPREHENSION
Word Pair #2
IMITATION
Word Pair #2
PRODUCTION*
Word Pair #2

*Production was taught only if the child did not reach criterion on the word pair during production probes.

represented a different sequence of imitation and comprehension training. The third condition investigated the effects of training imitation and comprehension simultaneously instead of sequentially as in condition 1 and condition 2. Each of the conditions are described in detail below.

Imitation/Comprehension (IM/COMP) - In this condition, four words (nouns) were taught in the order of:

(1) imitation with a referential object present, followed by

(2) comprehension training on the same four words.

Production training on the same four words followed comprehension training in this sequence if the child did not teach criterion on the words during production probes. The teacher conducted a production probe by holding up first one, and then the other object being trained in imitation or comprehension and asking "What's that?"

Comprehension/Imitation (COMP/IM) - In this condition, four words were taught in the order of:

(1) comprehension, followed by

(2) imitation training with a referential object present on the same four words.

In this sequence, production training followed imitation training if the child did not reach criterion on the production probes.

Simultaneous (SIM) - In this condition, imitation training and comprehension training were conducted simultaneously rather than sequentially as in conditions 1 and 2. The child began working simultaneously on two words in imitation and two different words in comprehension. As soon as the child reached criterion in imitation for one word pair he/she began working on the same two words in comprehension, then production (if necessary). Likewise, when the child reached criterion in comprehension for the other word pair, he/she began working on the same two words in imitation, then production (if necessary). The author decided that it was not possible to work on a single word pair simultaneously in imitation and comprehension for the following reason. Production probes were being conducted on the words being trained in both imitation and comprehension. If a child was simultaneously working on the same word pair in comprehension and imitation and a probe word reached criterion, it would be difficult to determine if acquisition of the probe was due to the comprehension training, the imitation training, or a combination of the both. The author decided to train imitation and comprehension components simultaneously but with two different words pairs (one beginning in comprehension, and one beginning in imitation).

Design. This study employed a within-subject design with inter-subject and intra-subject replication to test the effects of the three experimental conditions. In addition, the effects of sequential versus simultaneous presentation of conditions were studied (see Table 3).

Insert Table 3 about here

Table 3

Order of Conditions for Individual Children

		Intra-Subject Replication		
	Subject	First Condition Administered	Second Condition Administered	Third Condition Administered
Inter-Subject Replication	S_1	IM/COMP	COMP/IM	SIM
	S_2	IM/COMP	SIM	COMP/IM
	S_3	SIM	IM/COMP	COMP/IM
	S_4	SIM	COMP/IM	IM/COMP
	S_5	COMP/IM	IM/COMP	SIM
	S_6	COMP/IM	SIM	IM/COMP

IM/COMP -- Imitation/Comprehension Condition
COMP/IM -- Comprehension/Imitation Condition
SIM -- Simultaneous Condition

The independent variable in this study was the manner of introduction of imitation and comprehension training (imitation then comprehension; comprehension then imitation; imitation and comprehension together). The dependent variables studied when comparing the three conditions included:

(1) Mean sessions to criterion for imitation and comprehension training (group data);
(2) Total sessions to criterion for imitation and comprehension training (individual data);
(3) Percentage of probe words reaching criterion;
(4) Mean sessions to criterion for production training;
(5) Percentage of words passing Review;
(6) Percentage of words passing Maintenance;
(7) Percentage of words generalizing to a new stimulus object;
(8) Percentage of words generalizing to a different setting;
(9) Percentage of words generalizing to a different teacher;
(10) Error analysis of words reaching criterion during imitation training;
(11) Total spontaneous productions and delayed imitations.

Baseline Procedure. Six children meeting the criteria specified in the pretest acted as subjects for this study and proceeded to the baseline condition. Three separate baselines were given to each child (one at the beginning of each experimental condition). A separate list of nouns was used for each baseline. The three baseline lists may be found in Appendix B.

During the first two baselines, the children were tested on imitation, comprehension, and production of 16, one and two-syllable nouns. During the last baseline, the children were tested on imitation, comprehension, and production of only 12 one and two-syllable nouns. Fewer nouns were tested in the last baseline in order to shorten the baseline testing period (approximately one week). Decreasing the number of nouns in the last baseline still allowed the author to select a sufficient number of items to teach and reduced the amount of time that the children spent in the baseline procedure.

Nouns selected for the baseline represented objects that were present in the classroom setting. Objects fell into one of the following classes: clothing items (pants, dress); utensils (knife, spoon); toys (doll, teddy); teaching materials (pencil, tape); food (orange, lemon). Items selected for the baselines met the following criteria:

(1) the item was present in the classroom setting;

(2) the noun representing the item contained no more than two syllables;

(3) the object was small enough to fit on the stimulus board;

(4) The object could be varied along at least two stimulus dimensions for the purposes of generalization testing.

The difficulty in selecting items for the baselines cannot be overemphasized. Initially, the author attempted to analyse each word in the first list for sound characteristics (fricatives, blends, plosives, etc.) and have equal representation in the two other lists. For example, the word "pot" appears in the first baseline list. This word may be analyzed as follows:

p - stop
o - vowel
t - stop

This word could be balanced in the second and third baselines with words which contained two "stops" and one vowel (e.g. boot and tape).

Although it was possible to balance words in this fashion for the three baselines, the author was not able to accomplish this for all of the words in all three lists and satisfy the four criteria specified above. In addition, even if it had been possible to match the words in the three baselines, the author would have still had to contend with the physical dimensions of the objects representing the nouns, since comprehension was trained as well as imitation and production. Perhaps matching of words and objects could have been accomplished using nonsense syllables and contrived objects to represent these "words", however, the author did not consider this ethical, given the language level of the children involved and the amount of time that the children took to learn a few functional words.

It should be mentioned that many of the nouns used in this study had been used by the author in a previous study (McDonald, Note 2). A group of six Down's Syndrome children learned the nouns in imitation, comprehension, and production and in most cases generalized to a different teacher, a different setting, and maintained learned words over a minimum of 5 weeks.

A second problem encountered when selecting items for the baselines related to a "learning to learn" effect. By the time the children reached the third baseline, they would imitate most simple one-syllable words. In addition, it became more difficult to find objects that they could not identify in a four-choice discrimination task. For these reasons, words selected for the last baseline represented less common objects. In addition, the words representing the objects were considered more difficult (more blends, more two-syllable words).

All baselines were carried out by the classroom teachers with reliability checks conducted by the author. The three components of the baselines are described in detail below.

(1) Imitation Component - The 16 nouns (12 for the last baseline) were presented to each child in a random order on three separate occasions over a five day period. For each trial, the teacher held up the appropriate referent object at eye level and presented the instruction "Say (object name)". A correct response was defined as a verbalization made by the child within five seconds of the teacher's instruction which contained all of the phonemes in the stimulus word in order. An approximation was defined as any verbalization made by the child within

five seconds of the teacher's instruction which contained at least two but not all phonemes from the stimulus word in order. For example, the child might respond "at" for "cat". The teachers were requested to score an approximation and write exactly what they heard on the data sheet beside the word. An incorrect response was defined as any verbalization made by the child within five seconds of the teacher's instruction which did not meet the above two criteria. "No response" was recorded by the teacher if the child failed to respond within five seconds of the instruction.

(2) Comprehension Component - Comprehension of the nouns was assessed three times over a five day period using a four-choice discrimination task. The referent objects from the imitation component were used in the discrimination task. On each trial, the teacher placed four of the objects in front of the child on the stimulus board and requested "Show_______". Following the child's response or a five second period (whichever came first), the teacher would gather up the four items, change their order and place them on the stimulus board. This method was repeated until all four objects had been tested once. The teacher then selected the next set of four and continued until all objects had been tested once. This procedure was repeated on three occasions. The author decided which objects would be tested together in a group

according to the following criterion:

(i) nouns representing objects in the group could not rhyme,

(ii) each object varied from the other three objects along at least three of the following dimensions-size, shape, color, texture.

The teachers scored a correct response if the child pointed to or touched the named object; an incorrect response if the child pointed to an object other than the one named by the teacher; and "no response" if the child failed to point to or touch an object.

(3) Production Component - The nouns were presented to each child in a random order on three separate occasions over a five day period. On each trial, the teacher held up a referent object at eye level and asked the child "What's that?". Referent objects used were the same as those used in the imitation and comprehension components. Criteria for correct responses, approximations, incorrect responses, and no responses remained unchanged from those used in the imitation component.

The order of testing of the nouns in all three components was determined ahead of time by the author and programmed on the baseline data sheets.

During the baseline, the teachers did not provide consequences for any responses occurring within five seconds of an instruction or a question. Children were socially reinforced and given a primary reinforcer for appropriate sitting behavior on a variable ratio 2 (VR2) schedule of reinforcement. The VR2 schedule was marked on the baseline testing sheets for the teachers. Each time a trial was circled on the sheet, the teacher would reinforce the child for appropriate sitting at least five seconds after the instruction or question for that trial had been given.

The order of testing of the three baseline components was randomized across children over five testing days (See Table 4).

Insert Table 4 about here

Noun Selection Procedure. Following the completion of the three components of a baseline for a particular child, the author compiled a list of nouns that met the following conditions:

(1) no correct responses in either the imitation or the production components;

(2) no more than two instances of the same approximation to the word in either the imitation or the production components;

(3) fewer than two correct responses during the comprehension component.

Following the first baseline, the author selected four words from the list of eligible nouns which met the following conditions:

(1) the word had no more than one phoneme in common with the other words selected;

(2) the objects representing the words selected varied along at least three of the following

Table 4

Order of Baseline Presentation

Child	Day 1	Day 2	Day 3	Day 4	Day 5
Child 1	I & C	P & C	P & I	I & P	C
Child 2	I & P	C & I	P & C	I & C	P
Child 3	C & P	I & C	C & I	P & I	P
Child 4	P & C	C & P	I & P	C & I	I
Child 5	C & I	P & I	I & P	C & P	C
Child 6	P & C	I & C	C & P	P & I	I

C - Comprehension Baseline

I - Imitation Baseline

P - Production Baseline

> dimensions - color, shape, size, texture. The four words selected in this fashion were used for that child in the first experimental condition. When possible, the same four words were chosen across the children (when the words were not eliminated from the list because they did not meet the conditons specified above).

The author used the same criteria to select words following the second and third baselines. Words selected for conditions subsequent to the first met these additional two criteria:

(1) the word selected had no more than one phoneme in common with previous words selected for the child;

(2) the objects representing the nouns varied along at least three dimensions from objects previously selected.

General Teaching Procedure. Each child participated in daily individual sessions of 32 trials, regardless of the instructional procedure being used (imitation, comprehension or production). A 32 trial session took an average of 12 - 15 minutes to complete.

Children began the study completing one-half of a session or 16 trials each day and progressed to a daily 32 trial session as their attention span permitted. For the purposes of data analysis, one session was 32 trials (whether the trials were completed over one or two days).

The child began an experimental condition with a pair of words selected according to the criteria previously outlined. The two words were taught simultaneously and were randomly alternated by the teacher according to a schedule programmed on the data sheets.

The data collection format used in all three components of this study -- imitation, comprehension, and production was modelled after that used by Guess et al. (1976). This format was used for a number of reasons. The most important reason involved an effort to simplify the procedures in this study for the teachers. The teachers were familiar with this format as it was used for the language programs of all children who were able to imitate sound and two words. The author decided that the teachers were less likely to make errors when carrying out the procedures in this study if they were familiar with these procedures from previous experience. A second reason was that the author has previous practice in conducting inter-observer reliability checks using this program format. It would have taken additional time on the part of the author and the teachers if the author was required to conduct the inter-observer checks using the Behavior Analysis System (described in the Reliability section) on an unfamiliar procedure. A final reason was that this procedure taught items simultaneously rather than sequentially and there is literature to suggest that items taught simultaneously result in better generalization than items taught serially (Panyon and Hall, 1978; Shroeder and Baer, 1972).

Sessions continued on the word pair until one of the following occurred:

(1) the child obtained 80% or more over a 32 trial session;

(2) the child obtained 12 correct responses in a row during a session;

(3) the child exceeded 10 sessions on a word pair in a particular instructional procedure.

The first two criteria are consistent with the Functional Speech and Language Training Program for the Severely Handicapped (Guess et al. 1976). The last criterion was added after a child exceeded 10 sessions on a word pair in imitation and stopped responding. In the event of #1, 2, or 3, the teacher began working on the second pair of words and proceeded as for the first pair.

After sessions were completed on the four words in an instructional procedure, the child began on the next instructional procedure in the sequence with the same four words. This was continued until the four words had been trained in imitation, comprehension, and production (sequence would depend on the experimental condition). This procedure was repeated for each of the three experimental conditions. The SIM condition was slightly different in that the two instructional procedures (imitation and comprehension) were carried out simultaneously rather than sequentially. This condition still resulted in the four words being taught in imitation, comprehension and production.

Correct responses were socially reinforced with precise feedback ("Good saying _______" or "Good showing _______"), and a primary reinforcer was delivered on a continuous schedule of reinforcement until the child scored over 50% correct during a session. The day after the child scored over 50%, the schedule of reinforcement was changed to a variable ratio 2 (VR 2) schedule of reinforcement. The child remained on the VR 2 schedule until the next set of words were introduced or the child began to respond at less than 50% accuracy. When one or the other occurred, the child was returned to a continuous schedule until the 50% criterion was met. This procedure of adjusting the schedule of reinforcement allowed the teacher to give primary reinforcers on a continuous schedule when the child was making relatively few correct responses and consequently not receiving much reinforcement. The shift after 50% correct was intended to increase persistent responding and decrease the probability of satiation as the child made more correct responses. The shift from continuous to VR 2 schedule of reinforcement also made the two unreinforced probe items more difficult to discriminate.

Incorrect responses and instances of no response were followed by "No" and a correction procedure (Guess et al. 1976). Data was recorded on a trial-by-trial basis and is described separately for each instructional procedure in the next section.

The sessions were conducted by teachers and instructional assistants employed by the Edmonton Public School Board. For reporting purposes, both teachers and developmental assistants have been referred to as "teachers". Subjects 1, 2 and 3 received all of their sessions from the teacher and developmental assistant in Classroom 1. Subjects 4 and 5 received sessions from the teacher and developmental assistant in Classroom 1 and Classroom 2. This was necessary since these two children were in an afternoon class in which the teacher and developmental assistant were alternated every second week. Subject 6 received all sessions from the teacher and developmental assistant in Classroom 3. Reliability checks were carried out by the author on at least 10% of all sessions conducted by both teachers and developmental assistants.

Instructional Procedures. The three instructional procedures used in this study are described in detail below.

Imitation Training - During imitation training, the teacher secured the child's attention (Kysela et al. 1980), held up the appropriate referent object at eye level and gave the instruction "Say (object name)". The teacher scored an imitation trial as either correct, approximation, incorrect or no response.

(1) Correct response - The teacher scored a response as correct when the child verbally matched each phoneme in the stimulus word in the sequence modelled by the teacher (e.g. "ball" for "ball") within five seconds of the teacher's model; or after the child has scored 10 consistent although not necessarily consecutive approximations for that particular word. For example, after the child had responded to the stimulus word "cat" with the approximation "ca" on 10 different occasions, the teacher scored a correct response when

the child responded "ca" for "cat" on subsequent trials. Correct responses as defined above were socially reinforced on a continuous schedule ("Good saying object name"). Primary reinforcers were delivered on a continuous or variable ratio schedule according to the criteria previously described.

(2) Approximation - an approximation was scored if the child verbally matched some (at least two) but not all of the phonemes from the stimulus word in order within five seconds of the teacher's model. In addition to scoring (A), the teacher also recorded all of the phonemes in the order heard beside the appropriate word on the data sheet. This procedure enabled the teacher to determine when the child had made 10 consistent approximations to a particular word (see #1). The teacher never accepted the same approximation for more than one stimulus word. Approximations were treated as either correct or incorrect responses by the teachers. An approximation was treated as a correct response if it met the criteria stated in #1. An approximation was treated as an incorrect response if it met the criteria stated below in #3.

(3) Incorrect response - The teacher scored an incorrect response

  (a) If the student made any verbalization not meeting the requirements of #1 or #2 within five seconds of the teacher's model;

  (b) if the student made an approximation as defined in #2 that was not judged as acceptable by the teacher. An approximation was judged as unacceptable if: The child had not yet made 10 consistent approximations to the word; the child had responded previously with a more accurate approximation (e.g. the response "mi" for "milk" would be deemed unacceptable if the child responded "mil" for "milk" on a previous trial); the child responded with an approximation to the stimulus word that had been accepted as a correct response for another stimulus word.

(4) No response - The teacher scored "no response" if the child did not verbalize within five seconds of the teacher's model.

If the student made a correct response to the stimulus word, or responded with an approximation that met with the requirements of #1, the teacher reinforced the child with precise feedback and delivered a primary reinforcer if the schedule indicated that one should be delivered. The teacher then scored the trial on the data sheet. After recording the trial, the teacher proceeded with the next trial.

If the student made an incorrect response as defined in #3, or failed to respond within five seconds of the model, the teacher said "No" and a correction procedure followed. In this case, the teacher repeated the trial, giving the child a second opportunity to hear the model and make a response. The teacher scored the correction procedure in the same manner as the trial and contingencies specified in #1 - #4 were also in effect for the correction procedure. If the child made an incorrect response or no response during the correction procedure, the teacher terminated the trial by recording the data and began the next trial in the sequence. A flowchart of the imitation procedure may be found in Appendix C.

Comprehension Training - The format to train comprehension was similar to that used by Guess et al. (1976) in Step 2 of their program. The children were asked to point to one stimulus item with three distractor items present. Items were placed 5 cm apart on the stimulus board in front of the child. Since the child was working on a pair of words that randomly alternated throughout the session, one of the three distractor items for each child was the other object in the pair. The remaining two distractor items were a random assortment of items that had not yet been worked on.

The particular distractor items used were changed each day.

During comprehension training, the teacher set four objects in front of the child and gave the instruction "Show ________". A comprehension response was scored as correct (+), incorrect (-), or no response (NR).

(1) Correct response - A correct comprehension response was defined as the child pointing to or touching an object that corresponded to the object named by the teacher within five seconds of the instruction "Show _______".

(2) Incorrect response - An incorrect comprehension response was scored when the student pointed to or touched any object other than the one named by the teacher within five seconds of the teacher's instruction.

(3) No response - A "no response" was scored when the child failed to make a pointing or touching response.

If the child made a correct response as defined above, the teacher socially reinforced the child with precise feedback, delivered a primary reinforcer if the schedule indicated that one should be delivered, and scored a correct response on the data sheet.

When a student made an incorrect response or failed to respond within five seconds of the instruction, the teacher said "No" and a correction procedure followed. In this case, the teacher said "This is the (object name)" and pointed to the correct object. The teacher then repeated the instruction "Show _______." If the child responded correctly on the correction procedure, the teacher maintained the same contingencies present for a correct response during the trial. If the student responded incorrectly or failed to respond within five seconds of the instruction, the teacher terminated the trial by recording the data, then proceeded with the next trial. (See Appendix D for a flowchart of the comprehension procedure).

Production Training - The format used to train production was similar to that used by Guess, et al. (1976) in Step 1 of their program. During production training, the teacher held up the appropriate referential object at eye level and asked the question "What's that?". A production response was scored as either correct (+), approximation (A), incorrect (-), or no response (NR). The definitions for these responses were the same as those provided for the corresponding imitative responses #1-4 on pp.67-69 except that the production responses followed the question "What's that?" rather than the instruction "Say _____".

Contingencies for correct responses and acceptable approximations were the same as those specified for imitation training. If the student made an incorrect response or failed to respond within five seconds of the question, the teacher said "No" and a correction procedure followed. In this case, the teacher said "That's a _____", then repeated the question "What's that?". The correction procedure was consequated and scored in the same way as the trial.. If the child made an incorrect or no response following the correction procedure, the teacher terminated the trial by recording data and then proceeded with the next trial. (See appendix D for a flowchart of the procedure).

A child received training in the production instructional procedure only if the word pairs failed to meet criterion on the production probes described below.

Production probe trials. The teacher conducted a production probe on each of the words being taught during the course of each imitation and comprehension session. The two probe words were inserted on the data sheet between trials 8 and 9 and between trials 29 and 30. During a probe trial, the teacher held up the appropriate object and said "What's that?". The child's response was recorded as correct, approximation, incorrect or "no response" using the same criteria previously specified for the production component. Responses made during a probe were not consequated by the teacher. The teacher simply recorded the data for the production probe trial and proceeded with the next teaching trial. The order of presentation of the production probes was changed each session.

Production probes were not carried out during training in the production instructional procedure. Production probes were conducted during the imitation and comprehension procedures in order to determine the following:

(a) would the child respond to the production probes prior to any direct training on production;

(b) would the child reach criterion on a production probe more quickly when imitation was trained before comprehension, or the reverse?

Criterion on a production probe was defined as 3 consecutive correct responses (or three consistent consecutive approximations) on a probe item over 3 days. As was previously mentioned, the production procedure was taught only if the child did not reach criterion on the production probes. In a situation where a child reached criterion on one production probe but not on the second member of the pair, the author decided to work on both items in the production component until criterion was reached or for five sessions (whichever came first).

Review

Each time two items reached criterion in any instructional procedure (imitation, comprehension, or production), the two items were tested once at the beginning of the next five sessions. Scoring criteria remained unchanged from those used during sessions. After the items were tested five times on Review, they were placed on Maintenance.

Maintenance

Items placed on Maintenance were tested once a week for five weeks. Scoring criteria were the same as those in effect during sessions and Review.

Generalization

Items reaching criterion were tested for generalization to a new setting, to a new teacher, and to a different stimulus object representing the same noun.

Generalization to a new setting.

After a child reached criterion on a word pair during sessions, the teacher tested these words with the instructional procedure in which they had reached criterion in a different setting on three separate occasions. Generalization tests were conducted in an open play area of the classroom in the presence of other children. Since primary reinforcers were only administered in 1:1 language sessions in the language area, correct responses (the particular responses that had reached criterion during sessions) were socially reinforced but no primary reinforcers were delivered. A word was considered to have generalized to a new setting if the child scored a correct response on at least two of the three checks.

Generalization to a new object. After a child had reached criterion on a word pair during sessions, the teacher tested these words with the instructional procedure in which they had reached criterion using objects that varied along at least three dimensions from the original objects used during training. Three separate checks were completed in the language training area. Since these checks were conducted in the usual language setting, primary reinforcers as well as social reinforcers were delivered for correct responses. A word was considered to have generalized if the child responded correctly on a minimum of two of the three checks.

Generalization to a new teacher. After a child had reached criterion on a word pair during sessions, this author tested the word pair in the language area, using the instructional procedure on which they had reached criterion on three separate occasions. Primary reinforcers and social praise followed correct responses. A word was considered to have generalized if the child responded correctly on at least two of the three checks.

Spontaneous Productions and Delayed Imitations

As was previously mentioned, there was an element of comprehension training in the imitation component, since imitation training was conducted with the referent object present. There was also the possibility of imitation training taking place in the comprehension component if the child imitated the words modelled by the teacher in the instruction "Show ______". When the teacher reinforced the pointing response, she might also be reinforcing the imitative response without intending. Ruder et al (1977) eliminated this problem by discouraging subjects from imitating words during comprehension training. Discouraging imitation was not seen as desirable with these children since they were just beginning to verbalize and any effort to stop verbalizations would have been inappropriate. For this reason, the children were allowed to verbalize during comprehension training, however it was decided to keep track of these verbalizations to see if their presence was related to the outcome of the study.

Two types of verbalizations were recorded during comprehension training - spontaneous productions and delayed imitations. Each is described below.

Spontaneous Productions. A spontaneous production was recorded if the child labelled one of the two objects being trained in comprehension anytime during the 32 trial session. In order to be scored as a spontaneous production, the response could not occur sooner than 10 seconds after the teacher had named the object. A spontaneous production is defined as two or more phonemes (in order) contained in the label of either of the words being taught that is emitted at least 10 seconds after the teacher had modelled the label for that particular word.

Delayed imitations. A delayed imitation was recorded if the child labelled an object (with two or more phonemes in order) within 10 seconds after the teacher had named that object during a comprehension trial. The delayed imitations were easy to discriminate from the spontaneous productions because they usually occurred as the child touched the appropriate object.

Spontaneous productions and delayed imitations were not consequated by the teacher. The teacher simply recorded exactly what she heard on the data sheet next to the appropriate comprehension trial. Next to this she recorded an "SP" if the response was considered a spontaneous production and a "DI" if the response was considered a delayed imitation.

Error Analysis

An error analysis was completed on all verbalizations reaching criterion on imitation or production. Since approximations to words were being accepted as correct responses, there was a possibility that one condition may have resulted in better approximations (more phonemes matched for each label) than the other conditions. In order to determine if one condition resulted in better approximations, each word reaching criterion in imitation and production was assessed in order to determine if the utterance contained:

(1) Omissions - An omission was scored for each phoneme that was missing from a verbalization

that reached criterion. For example, if the child reached criterion on "ball" with the approximation "ba" he/she was scored for an omission on this word.

(2) Substitutions - A substitution was scored each time a phoneme in a word was replaced by another phoneme. For example, the child might reach criterion on the word "cookie" with the approximation "dookie".

(3) Additions - An addition was scored each time an extra phoneme not modelled by the teacher was added to the child's verbal response. For example, the child might reach criterion on the word "soap" with the approximation "sdoap:.

Reliability

Reliability checks were completed on both child responses and teacher instructional behavior using the Behavioral Analysis System (Hillyard, Kysela, and Davis, Note 3). The Behavior Analysis System could be used by an independent observer to score antecedent instructional events (gaining the child's attention; type of prompt given), child response (correct, incorrect, approximation, no response), and consequent events (social praise, consummable reinforcer, negative feedback).

Reliability checks were conducted by the author on 10% of all sessions (IM/COMP - 12%; COMP/IM - 8.3%; SIM - 10%). Of the 23 reliability checks administered, 11 were conducted during imitation training, 11 during comprehension training and one during production training.

During a reliability check, the author sat to one side of the language area and recorded events on the data sheet as they occurred. The reliability check continued until 10 complete trials had occurred. Following completion of the session the author compared her data on child responses to the teacher's data on child responses. Reliability coefficients were computed using the formula:

$$\frac{\text{agreements}}{\text{agreements plus disagreements}} \quad X \quad 100.$$

Reliability on child response data averaged 91%. The disagreements occurred when a child was beginning to make approximations to a word during imitation training. The teachers were procedurally correct 94% of the trials on which reliability checks were taken (IM/COMP - 93%; COMP/IM - 97%; SIM - 92%). All of the errors occurred during the consequent events. Occasionally, the teachers would fail to provide descriptive feedback or fail to conduct a correction procedure following an error.

On 10% of reliability checks conducted by the author, a second observer simultaneously conducted a second reliability check on the same session. The second observer sat on the other side of the session area so that she was unable to observe the author's data sheet. The second observer had been trained to use the B.A.S. but was not familiar with the children in this study.

Reliability between the author and the second observer was calculated as above.

Reliability between the author and the independent observer was an average of 87%. Disagreements between the author and independent observer occurred most frequently in the "child response" section. The discrepancy may have been due to the unfamiliarity of the independent observer with the children in this study.

CHAPTER V

RESULTS

The results of this study have been summarized in accordance with the five hypotheses outlined previously. The first section discusses conditions that were not completed. The second section summarizes the baseline results. The final section summarizes the results of this study as they relate to each of the five hypotheses.

Conditions Not Completed

Six children participated in this study an average of 11 months (4 months - 18 months). Sessions for S1, S3, S4, and S6 were conducted over two school terms (1978/79; 1979/80). All of S5's sessions were conducted during the 1979/80 school term. The lengthy experimental condition for most of the children and the late start of S5 resulted in the failure of four of the children to complete all three experimental conditions. Table 5 summarizes the conditions completed by each of the children over the course of this study.

Insert Table 5 about here

Three of the children (S3, S4, and S5) were unable to complete all three conditions by the summer of 1980. It was not possible to continue sessions in the fall of 1980 as all three children were moving to a new program. S6 was eliminated from the study after she completed the first experimental condition. She began to produce

Table 5

Conditions Completed

Child	Conditions in Order Completed		
S1	IM/COMP	COMP/IM	SIM
S2	IM/COMP	SIM	COMP/IM
S3	SIM	IM/COMP	COMP/IM*
S4	SIM	COMP/IM	IM/COMP*
S5	COMP/IM	IM/COMP	SIM*
S6	COMP/IM	SIM*	IM/COMP*

IM/COMP - Imitation/Comprehension Condition

COMP/IM - Comprehension/Imitation Condition

SIM - Simultaneous Condition

* - Conditions not completed by the child

nouns spontaneously following the Christmas break in 1979 and the teachers could not baseline sufficient one and two - syllable words for subsequent conditions.

Summer break between the two school terms occured on two occasions between conditions (S1 and S2) and on three occasions within an experimental condition (S3, S4, and S6). A summary of time spent in this study by individual children may be found in Table 6.

Insert Table 6 about here

Baseline Results

The baseline results are summarized in Figure 1. The results are presented in the order in which each child received the conditions. Thirteen separate baselines were administered (three for S1 and S2; two for S3, S4, and S5; one for S6). Children scored the highest percent correct in comprehension ($\bar{x}$ = 43%), the next highest in imitation ($\bar{x}$ = 29%), and the lowest percent correct in production ($\bar{x}$ = 12%). This trend was observed for 11/13 baselines administered.

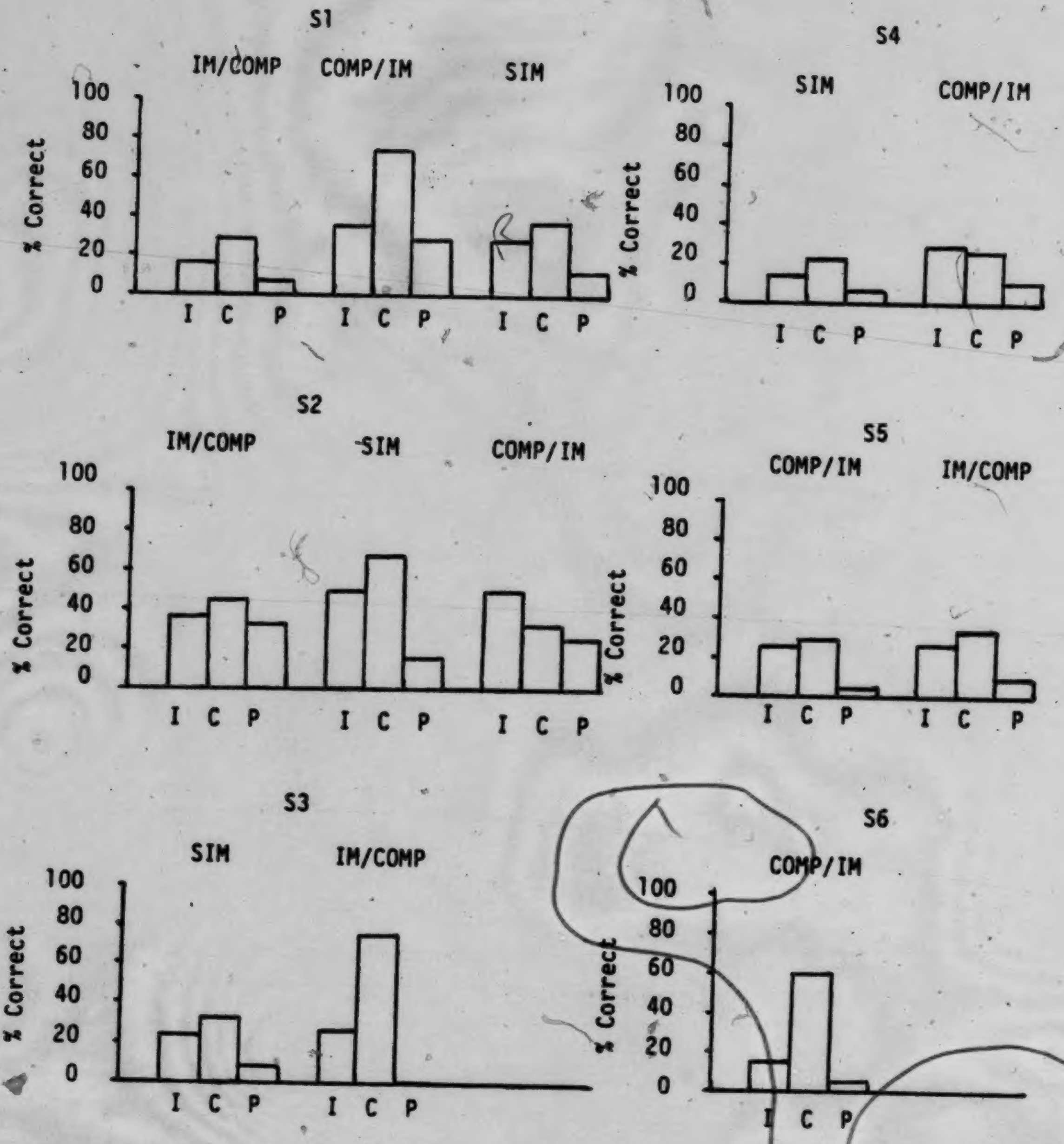
Insert Figure 1 about here

Table 6

Time Spent in the Study

Child	Condition	Months In Study	Total
S1	IM/COMP	6 months	
	(Summer Break)		
	COMP/IM	5 months	
	SIM	3 months	14 months
S2	IM/COMP	1 month	
	SIM	4 months	
	(Summer Break)		
	COMP/IM	2 months	7 months
S3	*SIM	9 months	
	IM/COMP	5 months	14 months
S4	SIM	6 months	
	*COMP/IM	12 months	18 months
S5	COMP/IM	2 months	
	IM/COMP	2 months	4 months
S6	*COMP/IM	7 months	7 months

IM/COMP - Imitation/Comprehension Condition
COMP/IM - Comprehension/Imitation Condition
SIM - Simultaneous Condition
* - Summer break occurred within the condition



KEY:
I - Imitation C - Comprehension P - Production
IM/COMP - Imitation/Comprehension Condition
COMP/IM - Comprehension/Imitation Condition
SIM - Simultaneous Condition

Figure 1: Baseline results in order in which conditions were administered

Experimental Results

Hypothesis #1 - Training comprehension before imitation (COMP/IM) will result in fewer mean sessions to criterion for imitation and comprehension training and greater savings in instructional time than training the alternate sequence (IM/COMP).

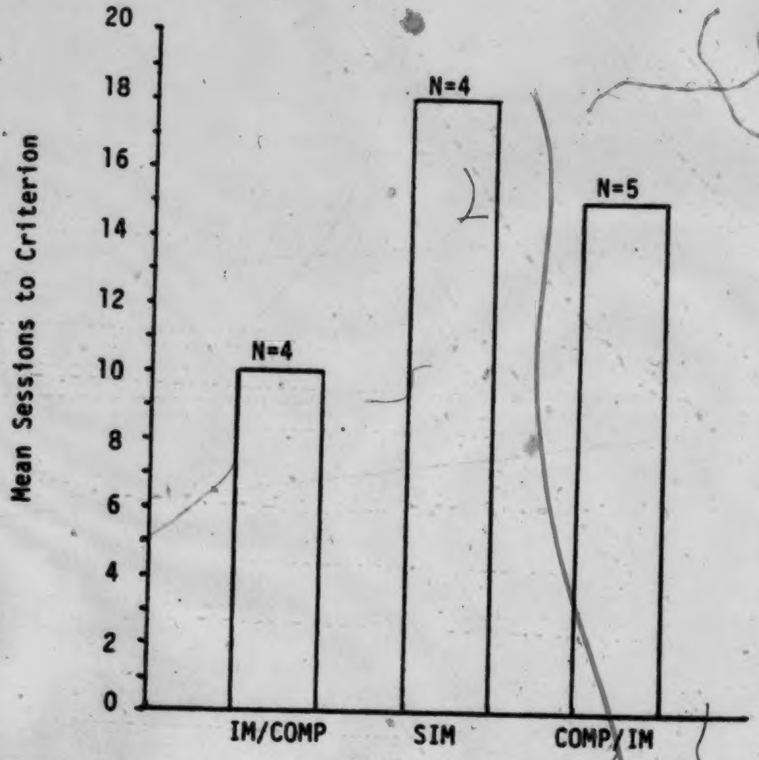
The sessions to criterion data has been summarized on three levels:

(1) mean sessions to criterion (group data);
(2) total sessions to criterion (individual data); and
(3) total sessions to criterion for individual word pairs in each condition.

Individual word data for each child may be found in Appendix D.

(1) Mean Sessions to Criterion (Group Data). Mean sessions to criterion data for each of the three conditions may be found in Figure 2. Total sessions to criterion for each condition were computed by adding together the sessions to criterion for imitation training and the sessions to criterion for comprehension training. The mean was computed by dividing the total sessions to criterion for each condition by the number of children receiving the condition. The sessions to criterion for production training in each condition were not included in the totals for two reasons:

Insert Figure 2 about here



KEY:

IM/COMP - Imitation/Comprehension Condition
SIM - Simultaneous Condition
COMP/IM - Comprehension/Imitation Condition

Figure2: Mean sessions to criterion for each condition. The number of subjects included in each condition is indicated at the top of the bar.

(i) production was not always taught;

(ii) production training was discontinued if the child did not reach criterion on the two word pairs within five sessions.

The IM/COMP condition required the fewest mean sessions to criterion. A comparison of the IM/COMP condition with the other two conditions revealed that COMP/IM required an average of 50% more sessions to criterion and SIM required an average of 80% more sessions to criterion than the IM/COMP condition.

Children did not always reach criterion on both word pairs in imitation and comprehension in a particular condition. Two of the children (S1 and S6) failed to teach criterion in imitation and comprehension on one of the two word pairs taught in the COMP/IM condition. Three of the children (S2, S3, and S4) failed to reach criterion in imitation and comprehension on one of the two word pairs taught in the SIM condition. In contrast, all children receiving the IM/COMP condition reached criterion on both word pairs in both imitation and comprehension. If the children had been allowed to continue sessions on a word pair until criterion was reached in both imitation and comprehension, the mean sessions to criterion for the COMP/IM and SIM conditions would have been even greater than is evidenced in Figure 2.

Sessions were discontinued on a word pair during imitation or comprehension training if:

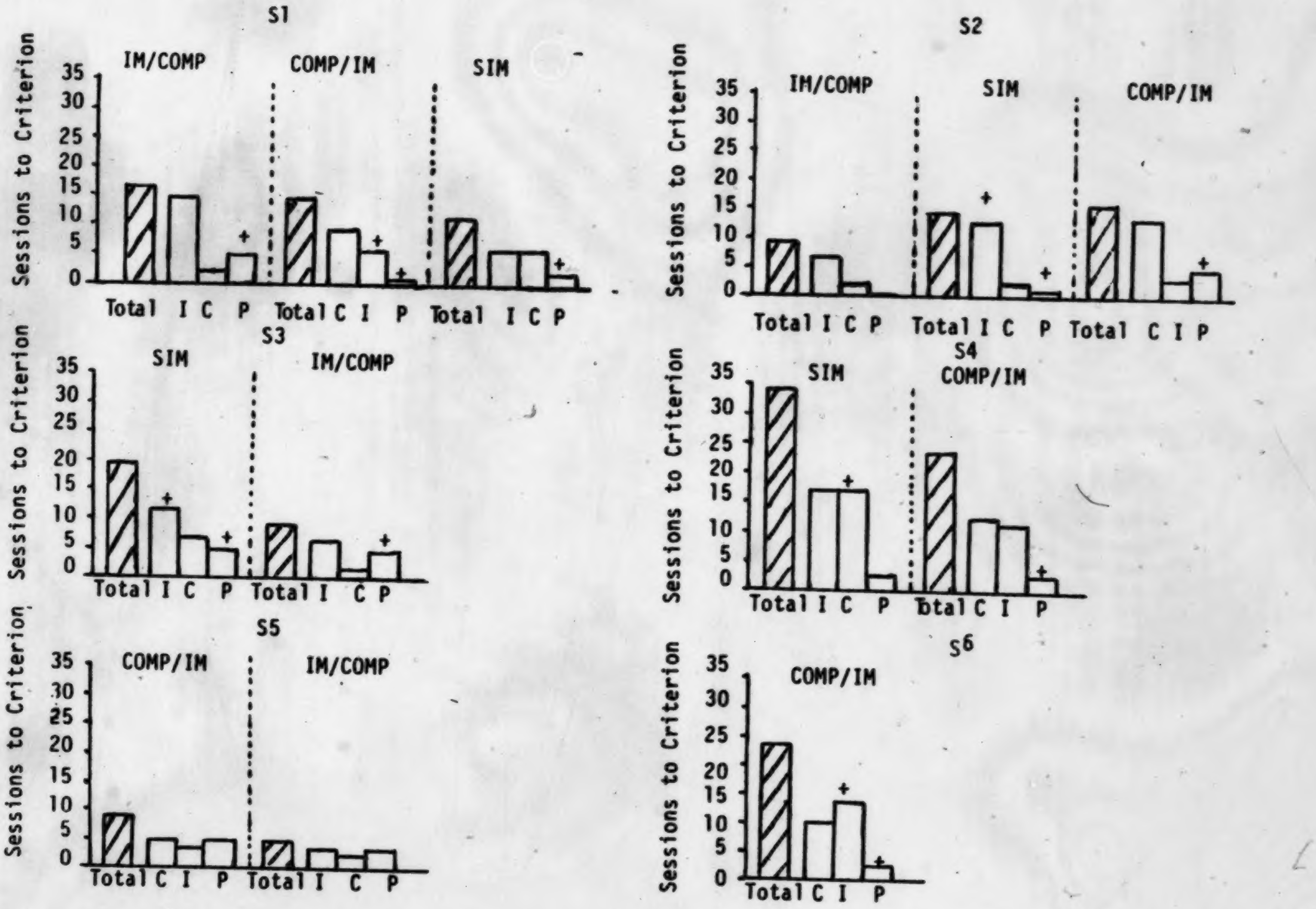
(1) the child exceeded 10 sessions on the word pair in either imitation or comprehension;

(2) the child failed to make a correct response or an acceptable approximation to a word after five consecutive sessions in imitation training.

In summary, children in the IM/COMP condition required fewest mean sessions to criterion; children in the COMP/IM condition required the next highest mean sessions to criterion; and children in the SIM condition required the greatest mean sessions to criterion.

(2) Sessions to Criterion (Individual Data). An examination of the sessions to criterion data for individual children (see Figure 3) revealed that the total sessions to criterion for S1, S3, S4, and S5 decrease with subsequent conditions. Comparisons of the IM/COMP condition with either the COMP/IM condition and/or the SIM condition was possible for S1, S2, S3, and S5. Three of the four children (S2, S3 and S5) replicated the group data results in that the IM/COMP condition required fewer total sessions to criterion for imitation and comprehension training than the other two conditions. The SIM and COMP/IM conditions required an average of 83% (range 50% - 100%) more sessions than the IM/COMP

Insert Figure 3 about here



KEY:

+ - Criterion not reached on both word pairs
Total - Total Sessions in Imitation and Comprehension Combined
IM/COMP- Imitation/Comprehension Condition
SIM - Simultaneous Condition
I - Imitation
C- Comprehension
P - Production
COMP/IM - Comprehension/Imitation Condition

Figure 3: Sessions to criterion for each child in all conditions administered

condition for S2, S3, and S5.

In summary, three of the four children receiving the IM/COMP condition required fewest total sessions to criterion in the IM/COMP condition when compared to either one or both of the remaining two conditions (COMP/IM and SIM).

(3) Sessions to Criterion for Individual Word Pairs. Data on individual word pairs was examined in order to determine if there was a difference in trials to criterion for a particular word pair if imitation was trained before or after comprehension. Up to this point, the data was combined for both word pairs taught.

Data was examined separately for word pairs taught with imitation training preceding comprehension training (IM/COMP) with comprehension training preceding imitation training (COMP/IM). The SIM condition was also included in this level of analysis. Although imitation and comprehension were trained simultaneously in this condition with two different word pairs, one word pair began with imitation training and the second word pair began with comprehension training. It was possible to separate the sessions to criterion for the word pair taught with imitation training preceding comprehension training from the word pair taught with comprehension training preceding imitation training (see Figure 4).

Insert Figure 4 about here

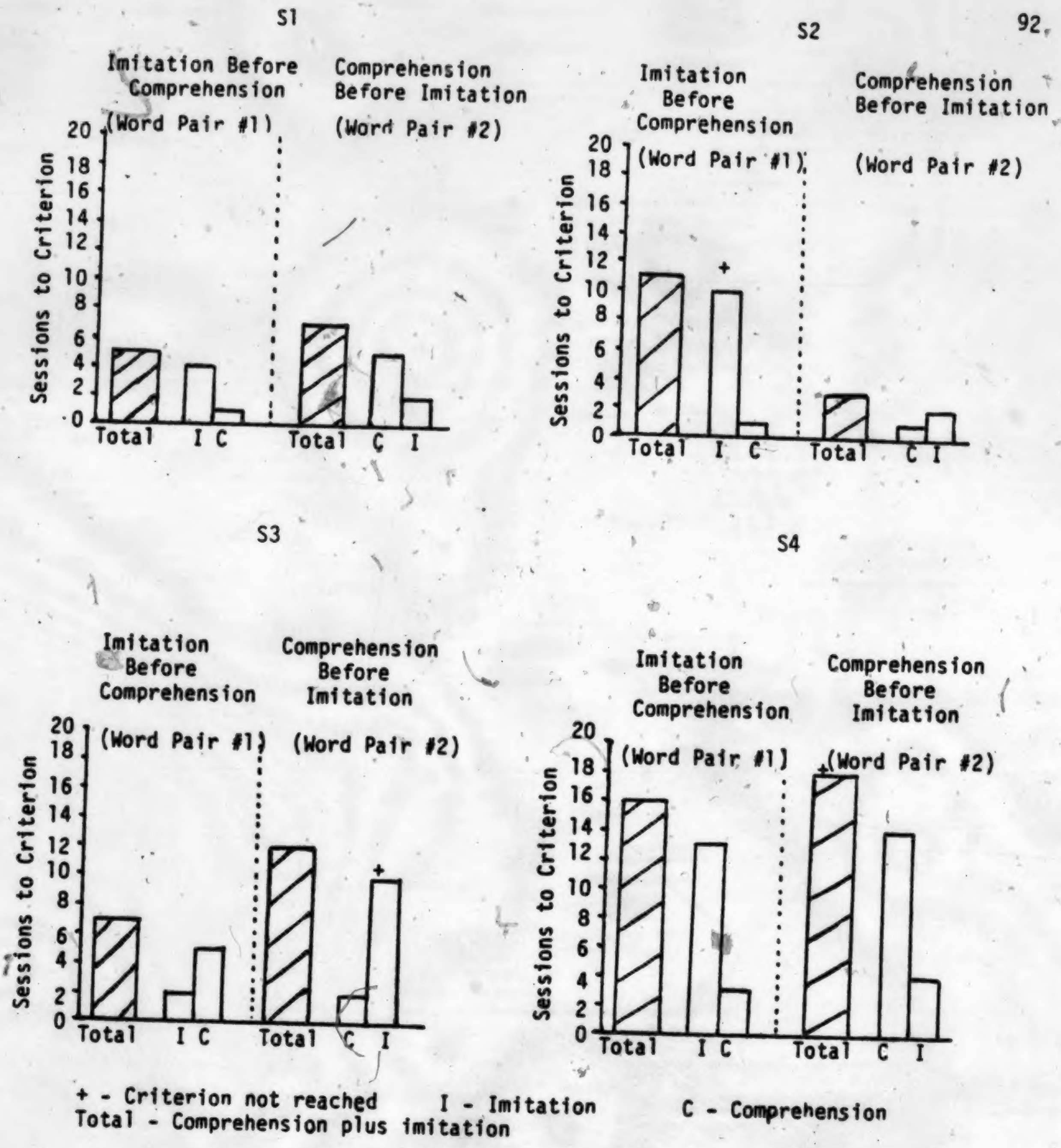


Figure 4: Simultaneous condition: Data graphed separately for word pair taught in imitation then comprehension vs word pair taught in comprehension then imitation.

Three of the four children receiving the SIM condition (S1, S2, and S4) required fewer total sessions to criterion for word pairs taught with imitation preceding comprehension (IM/COMP) training than word pairs taught in the alternate sequence (COMP/IM).

In order to examine the effect of the order of imitation and comprehension training on individual word pairs more closely, data was combined for the three conditions (IM/COMP, COMP/IM and SIM). Figure 5 presents the data on individual word pairs that were taught with imitation training preceding comprehension training.

Insert Figure 5 about here

Word pairs in both the IM/COMP and SIM conditions were included.

The children reached criterion in imitation and comprehension on 92% (11/12) of the word pairs taught with imitation training preceding comprehension training. They required an average of 4.5 imitation sessions and 1.5 comprehension sessions. Four of the children (S1, S2, S4 and S5) required fewer sessions to criterion in the second instructional procedure than in the first for all word pairs taught in the IM/COMP sequence.

Figure 6 compares sessions to criterion for imitation and

Insert Figure 6 about here

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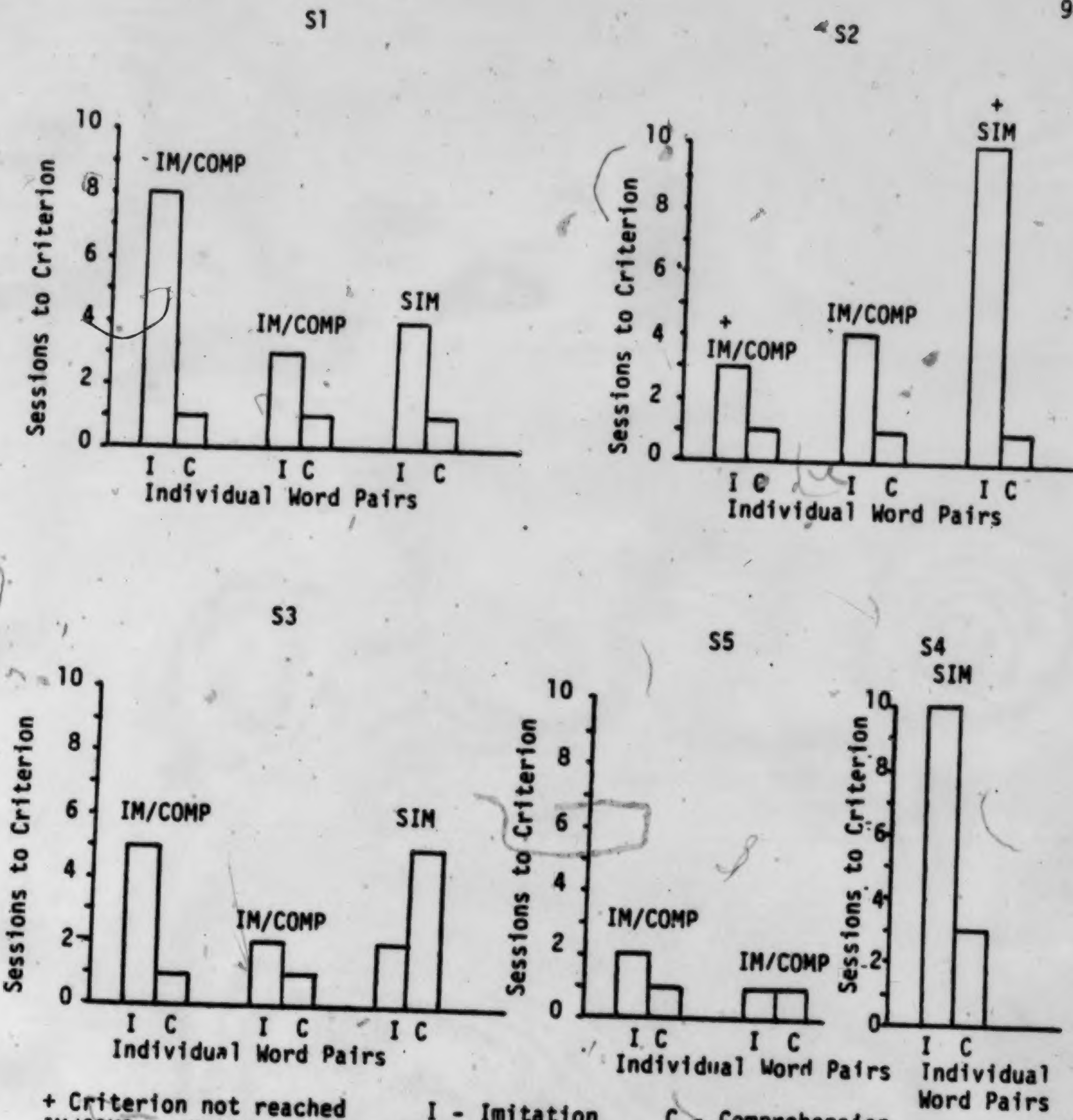
comprehension training when comprehension was trained prior to imitation. This occurred in the COMP/IM and SIM conditions.



+ Criterion not reached I - Imitation C - Comprehension
IM/COMP - Imitation/Comprehension Condition
SIM - Simultaneous Condition

Figure 5: Comparison of trials to criterion for imitation and comprehension when imitation was trained before comprehension.

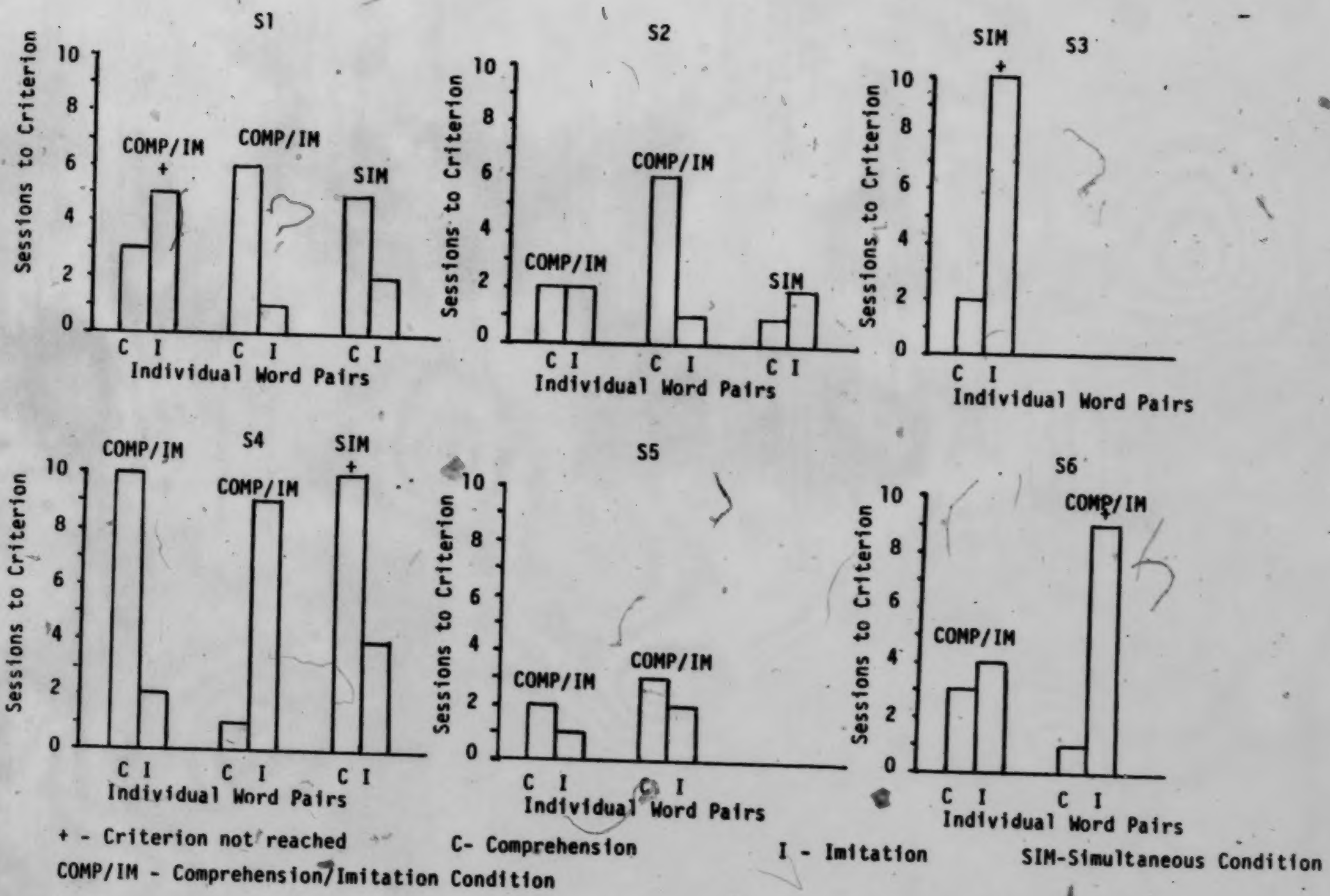


Figure 6: Comparison of trials to criterion for imitation and comprehension when comprehension was trained before imitation.

The children reached criterion in imitation and comprehension on 71% (10/14) of the word pairs taught with comprehension training preceding imitation training. They required an average of 3.9 sessions in comprehension and 3.9 sessions in imitation. Only one child (S5) required fewer sessions to criterion in the second instructional procedure than in the first for all word pairs taught in the COMP/IM sequence.

In summary, there was a greater percentage of word pairs reaching criterion in both imitation and comprehension training when imitation training preceded comprehension training. In addition, there appeared to be a greater savings in sessions to criterion for the second instructional procedure than the first, when imitation training preceded comprehension training.

A sensitizing quotient (Ruder, 1978) was computed in order to determine:

(a) If there was an interdependence between imitation and comprehension training (training in one instructional procedure affected performance in the other); and

(b) if one training sequence as opposed to the alternate sequence was optimal for the acquisition of both behaviors.

The ratio of mean sessions to criterion for imitation trained after comprehension (COMP/IM) to mean sessions to criterion for imitation trained first (IM/COMP) was 3.9: 4.5. This yielded a sensitizing quotient of .87. According to Ruder (1978) this would indicate some effect of initial comprehension training on subsequent imitation training. The ratio of mean sessions to criterion for comprehension trained after imitation (IM/COMP) to mean sessions to criterion for comprehension trained first (IM/COMP) was 1.5: 39. The resulting sensitizing quotient (.38) indicated a strong effect of initial imitation training on subsequent comprehension training. A comparison of the two sensitizing quotients indicated interdependence between imitation and comprehension performance and the direction of that interdependence favored training imitation before comprehension.

Section Summary. Group data indicated that the IM/COMP condition required fewest mean sessions to criterion; the COMP/IM condition required greater mean sessions to criterion; and the SIM condition required the greatest mean sessions to criterion. Individual data for 3/4 children for which a comparison was possible supported the conclusion that the IM/COMP condition required the fewest mean sessions to criterion when compared with the other two conditions.

An analysis of sessions to criterion data for individual word pairs indicated that a greater percentage of word pairs reached criterion in both imitation and comprehension when imitation training preceded comprehension training. In addition, a greater percentage of word pairs taught with imitation training preceding comprehension training showed a reduction in sessions to criterion from the first instructional procedure to the second instructional procedure, than word pairs taught in the alternate sequence. Computation of a sensitizing quotient (Ruder, 1978) supported the conclusion that the IM/COMP training sequence was the most efficient training sequence when compared with the COMP/IM training sequence.

Hypothesis #2A - Criterion will be reached on a production probe only after both imitation and comprehension training have occurred.

A production probe was considered to have reached criterion if the child made a correct response (or an acceptable approximation) to the probe on three consecutive occasions.

Table 7 summarizes the production probe data.

Insert Table 7 about here

Children reached criterion on a total of 13 production probes. For seven production probes (54%), children required both imitation and comprehension training before reaching criterion. Children reached criterion on 5 production probes (38%) after only imitation training; and on one production probe (8%) after only comprehension training.

Hypothesis #2B - Training comprehension before imitation (COMP/IM) will result in : (1) a greater percentage of production probes reaching criterion and (2) a greater percentage of

Table 7

Production Probe Data

Child	Condition	Word Pair	(Percent Correct) Sessions																	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
S1	IM/COMP	1	0	50	50	0	50	50	50	0	0	0	50	50/	50					
		2	0	50	50/	50														
	COMP/IM	1	0	0	50/	0	0	0	0	0										
		2	50	50	100	50	50	50/	50											
	SIM	1	50	0	0	0	0/	0	50											
		2	50	50	100	100/	100													
S2	IM/COMP	1	0	0	50/	100														
		2	0	50	100/	100														
	SIM	1	0/	50	50															
		2	50	0	50	0	50	50	50	50	50	50/	50							
	COMP/IM	1	0	0	50															
		2	0	0	50	0	100	50/	50	-										
S3	SIM	1	0	0/	0	0	0	0	0											
		2	0	0/	0	0	0	0	0	0	0	0	0	0	50	0				
	IM/COMP	1	0	0	0	0	0/	0												
		2	0	50/	0															
S4	SIM	1	50	50	100	0	0	50	50	0	50	100	50	50	-/	50	50	50		
		2	0	0	0	0	0	50	0	50	0	50	0	0	0	0/	0	0	50	50
	COM/IM	1	0	0	0	0	0	0	0	0	50	0	50/	50						
		2	0/	50	0	0	50	50	0	50	50	60								
S5	COM/IM	1	0	0	-															
		2	0	50	0/	0	0													
	IM/COMP	1	0	0/	0															
		2	-/	50																
S6	COMP/IM	1	0	50	50/	100	50	60	50											
		2	0/	0	0	50	0	0	0	0	0	0	0							

IM/COMP - Imitation/Comprehension Condition
COMP/IM - Comprehension/Imitation Condition
SIM - Simultaneous Condition
A Hyphen (-) indicates probe data was not recorded for a particular session
A Solid Line (/) indicates a change in instructional procedure from imitation to comprehension or comprehension to imitation.
A Circle-O indicates criterion was reached on a production probe during that session.

words trained in production reaching criterion within five sessions, than the alternate sequence (IM/COMP).

(1) Production Probe Data. The children reached criteron on 25% of the production probes in each of three conditions: IM/COMP - 4/16; COMP/IM - 5/20; SIM - 4/16; (see Table 7). None of the conditions resulted in a greater percentage of production probes reaching criterion.

If the results of production probes for the SIM condition in this study are examined, all 4 of the probe words reaching criterion in this condition were trained in the sequence - imitation then comprehension. If these results are combined with the production probe results in the other two conditions, children reached criterion on 8/13 (62%) of the probes when the training sequence was imitation followed by comprehension. In contrast, children reached criterion on 5/13 (38%) of the probe words when the training sequence was comprehension followed by imitation.

Children reached criterion on production probes in an average of five sessions in IM/COMP, 6 sessions in COMP/IM, and 5 sessions in SIM. It was not possible to compare stability of probe performance since the number of probe trails varied considerably. As soon as the child went on to a new word pair, the probe words were discontinued and replaced by the new word pair.

(2) Production Training Data. Sessions to criterion data for production training were examined in order to determine if the COMP/IM

condition resulted in a greater percentage of production words taught reaching criterion. Production words were taught following imitation and comprehension training for a maximum of five sessions if the child failed to reach criterion on a word pair during production probes. The production data is summarized in Table 8.

Insert Table 8 about here

A total of 32 words were trained during production training. Fourteen words were not trained because children reached criterion on these words during production probes. The remaining six words were not trained because:

(1) the child failed to reach ceriterion on the word during imitation training (if the child had not learned to imitate the word it was extremely unlikely he/she would learn to label the word within five sessions); or

(2) the end of the 1979/80 school term was reached before sessions were completed.

The SIM condition resulted in the highest percent of probe words reaching criterion following training (77%). The COMP/IM condition resulted in the next highest percent (73%) and the IM/COMP resulted in the lowest percent probe words reaching criterion (67%).

Hypothesis #3 - The order of imitation and comprehension training (IM/COMP; COMP/IM or SIM) will not affect follow up results.

In the present study, follow up checks were taken once a day

Table 8

Production Training Data

	% Words Reaching Criterion/Words Taught		
	CONDITION		
CHILD	IM/COMP	COMP/IM	SIM
S1	50% (2/4)	100% (2/2)	100% (2/2)
S2	- (0/0)	0% (0/3)	100% (2/2)
S3	50% (2/4)	*	0% (0/2)
S4	*	100% (2/2)	100% (3/3)
S5	100% (4/4)	100% (4/4)	*
$\bar{x}$ =	67% (8/12)	73% (8/11)	77% (7/9)

* Conditions not completed

IM/COMP - IMITATION/COMPREHENSION CONDITION

COMP/IM - COMPREHENSION/IMITATION CONDITION

SIM - SIMULTANEOUS CONDITION

for five days (Review) and once a week for five weeks (Maintenance) after a child reached criterion on a word pair. Group review and maintenance data are presented in Figure 7.

Insert Figure 7 about here

There is little difference in mean percent correct for Review and Maintenance among the three conditions. The mean percent correct for Review (90%) was slightly higher than the mean percent correct for Maintenance (85%). The Review and Maintenance data for individual children across conditions did not indicate that one condition resulted in a higher mean percent correct responses in either Review or Maintenance. Individual Review and Maintenance data may be found in Appendix E.

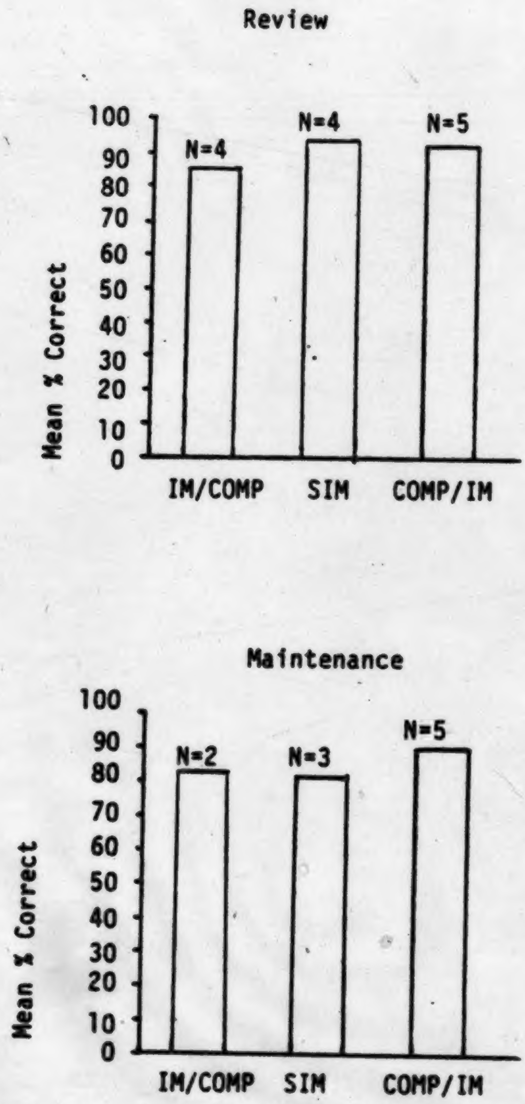
Hypothesis #4. _Simultaneous presentation of imitation and comprehension training (SIM) will result in increased generalization performance (higher percentage correct responses) than sequential presentation of imitation and comprehension (IM/COMP or COMP/IM)._

The generalization results are summarized in Figure 8.

Insert Figure 8 about here

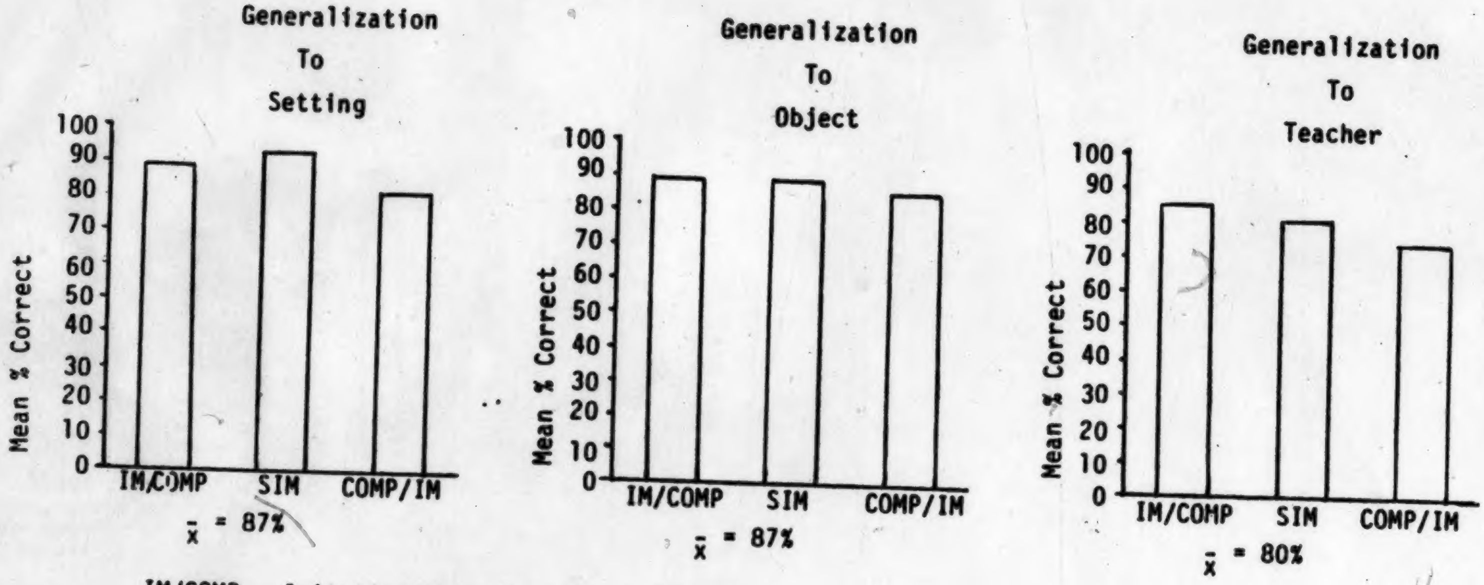
The teachers conducted generalization tests for word pairs on which children reached criterion. Generalization was tested:

(1) in a different setting;
(2) with a different object; and
(3) with a different teacher.



IM/COMP - Imitation/Comprehension Condition
SIM - Simultaneous Condition
COMP/IM - Comprehension/Imitation Condition

Figure 7: Group Review and Maintenance Data.



IM/COMP - Imitation/Comprehension Condition
COMP/IM - Comprehension/Imitation Condition
SIM - Simultaneous Condition

Figure 8: Group generalization data

There was little difference in the mean percent correct for the three types of generalization among the three conditions. The children scored the lowest mean percent correct in the COMP/IM condition for all three types of generalization. They scored an average of 87% correct in both generalization to a different setting and object when the data was averaged across the three conditions. Children scored an average of 80% correct for generalization to a different teacher, across the three conditions.

Table 9 summarizes the percent correct for the three types of generalization for each individual child. Each type of generalization will be discussed separately.

Insert Table 9 about here

Generalization to a different setting. It was possible to compare generalization to a different setting between the SIM condition and the other two conditions with S1, S2, S3 and S4. All four children attained a higher percent correct in the SIM condition when compared with either the COMP/IM and/or the IM/COMP conditions. The mean difference between children in the SIM condition and the IM/COMP condition was 7%. The mean difference between the children in the SIM condition and the COMP/IM condition was 18%. Both differences favoured the SIM condition.

Generalization to a different object. It was possible to compare generalization to a different object between the SIM condition and the other two conditions with S1, S2, S3, and S4.

Table 9

Generalization Results for Individual Children

		Type of Generalization			
Child	Condition	Setting % Correct	Object % Correct	Teacher % Correct	$\bar{x}$
S1	IM/COMP	90%	90%	90%	90%
	COMP/IM	88%	100%	83%	90%
	SIM	96%	100%	-	98%
S2	IM/COMP	92%	92%	83%	90%
	SIM	100%	100%	100%	100%
	COMP/IM	75%	88%	75%	79%
S3	SIM	83%	83%	100%	89%
	IM/COMP	77%	83%	83%	81%
S4	SIM	92%	67%	42%	67%
	COMP/IM	63%	83%	75%	74%
S5	COMP/IM	96%	79%	-	88%
	IM/COMP	97%	-	-	-
S6	COMP/IM	83%	75%	67%	79%
	$\bar{x}$ =	87%	87%	80%	

- Indicates missing data

IM/COMP - Imitation/Comprehension Condition

COMP/IM - Comprehension/Imitation Condition

SIM - Simultaneous Condition

Three of the children (S1, S2, and S3) attained the same percent correct or a higher (highest) percent correct in the SIM condition. The mean difference between the SIM and IM/COMP conditions was 6% and favored the SIM condition. The mean difference between COMP/IM and SIM favored the SIM condition for S1 and S2.

Generalization to a different teacher. It was possible to compare generalization to a different teacher between the SIM condition and the other two conditions with S2, S3, and S4. Two of the three children (S2 and S3) attained the higher (highest) percent correct in the SIM condition. The mean difference between SIM and IM/COMP was 17% and favored the SIM condition. The mean difference between COMP/IM and SIM favored SIM for S2.

In summary, the SIM condition resulted in equal or greater percent correct generalization responses when compared with the other two conditions for all children, but S4.

Hypothesis #5. Comprehension training preceding imitation training (COMP/IM) will result in a smaller percentage of articulation errors (determined through error analysis) for criterion words in imitation.

Criterion words during imitation training were examined in order to determine if the type of response reaching criterion was affected by the condition in which the word was taught. It was decided not to do an error analysis on criterion words in production training as the children maintained the same approximations from imitation to production training. The error analysis data is summarized in Table 10. A correct response was scored if the word

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Insert Table 10 about here

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reaching criterion matched the stimulus word modelled by the teacher in all respects (e.g. "purse" for "purse"). The COMP/IM condition resulted in the greatest percentage of correct criterion words following imitation training. This also held true when data from words taught in the sequence "comprehension then imitation" and "imitation then comprehension" sequence, in the SIM condition were included in the calculations.

The approximations reaching criterion were scored as substitutions, omissions, additions and combination (e.g. substitution and omission error) A substitution was scored if the child substituted one phoneme for another phoneme (e.g. "dat" for "cat"). An omission was scored if the child failed to imitate one of the phonemes in a stimulus word (e.g. "all" for "ball"). An addition was scored if the child added a phoneme not present in the stimulus word (e.g. "ballee" for "ball). A combination was scored if the child made two different articulation errors on a criterion word. For example, a word might contain an omission and a substitution (e.g. "dema" for "lemon").

Table 10

Error Analysis for Imitation Training

	CONDITION				
Response	IM/COMP		COMP/IM		SIM
	Alone	Combined*	Alone	Combined*	
Correct	0%	4%	19%	18%	15%
Approximations					
Substitution	13%	17%	13%	13%	23%
Omission	69%	61%	63%	55%	38%
Addition	0%	0%	0%	0%	0%
Combination	19%	17%	6%	13%	23%

*The combined categories for IM/COMP and COMP/IM conditions indicate data was included from the SIM condition for word pairs taught in the appropriate sequence.

IM/COMP - Imitation/Comprehension Condition
COMP/IM - Comprehension/Imitation Condition
SIM - Simultaneous Condition

The SIM condition resulted in the greatest percent substitution and combination errors. The IM/COMP condition resulted in the greatest percent omission errors. There were no recorded instances of addition errors. The data from the SIM condition was separated for the word pair taught with imitation preceding comprehension and then taught in the reverse sequence. The data was combined with either the IM/COMP condition data or the COMP/IM condition data (whichever was appropriate).

In summary, the COMP/IM condition resulted in a greater percentage of correct responses reaching criterion in imitation when compared with the other two conditions. There appeared to be no pattern to the type of articulation error made as a result of condition.

Delayed Imitations and Spontaneous Productions.

Ruder et al. (1974, 1977) had expressed concern that allowing a child to verbalize during comprehension training could affect the outcome of the production probe data. Teachers in the present study were requested to record all instances of verbalization during comprehension training.

A delayed imitation was scored if the child made a correct response or an acceptable approximation to a word modelled by the teacher within 10 seconds of the teacher's model. A spontaneous production was scored if the child labelled one or the other words in comprehension training at least 10 seconds after the teacher had named either item ("Point to the ball").

Delayed Imitation - Summary data on delayed imitations may be found in Table 11.

Insert Table 11 about here

Children in the SIM condition imitated during comprehension training at least twice as often as the other two conditions.

Spontaneous Productions - The children never uttered spontaneous productions during comprehension training. If a child labelled one of the comprehension training items, he/she usually did so as he/she pointed to the object within five seconds of the teacher's instruction "Show me ______".

Summary. The results of this study supported the following hypotheses:

(a) Hypothesis #3 - The order of imitation and comprehension training (IM/COMP; COMP/IM or SIM) will not affect follow-up results.

(b) Hypothesis #4 - Simultaneous presentation of imitation and comprehension training (SIM) will result in increased generalization performance (higher percent correct responses than sequential presentation of imitation and comprehension-IM/COMP or COMP/IM).

(c) Hypothesis #5 - Comprehension training preceding imitation training (COMP/IM) will result in a smaller percentage of articulation errors (de-

Table 11

Percentage of Delayed Imitations to Total Trials in Comprehension Training

CHILD	Conditions IM/COMP	COMP/IM	SIM
S1	13%	9%	20%
S2	16%	15%	27%
S3	0%	-	7%
S4	-	0%	3%
S5	0%	0%	-
S6	-	4%	-
$\bar{x}$ =	7%	5.6%	14%

- Indicates conditions not completed

IM/COMP - Imitation/Comprehension Condition
COMP/IM - Comprehension/Imitation Condition
SIM - Simultaneous Condition

termined through error analysis) for criterion words in imitation.

The results of this study did not support the following hypotheses:

(a) Hypothesis #1 - Training comprehension before imitation (COMP/IM) will result in fewer mean sessions to criterion for imitation and comprehension training and greater savings in instructional time than training the alternate sequence (IM/COMP).

(b) Hypothesis #2A - Criterion will be reached on a production probe only after both imitation and comprehension training have occurred.

(c) Hypothesis #2B - Training comprehension before imitation (COMP/IM) will result in:

  (i) A greater percentage of production probes reaching criterion, and

  (ii) A greater percentage of words trained in production reaching criterion within five sessions, than the alternate sequence (IM/COMP).

CHAPTER VI

DISCUSSION

The principal question addressed by the present research was whether one sequence of imitation and comprehension training resulted in greater instructional savings than the alternate sequence. A second question of concern was whether simultaneous presentation of training items was more or less effective than sequential presentation of training items. Five hypotheses related to these two questions were examined.

Six moderately/severely retarded children were taught imitation, comprehension, and production (if necessary) of one and two-syallable nouns in one or more of the following conditions:

(1) imitation, then comprehension, then production (IM/COMP);

(2) comprehension, then imitation, then production (COMP/IM);

(3) imitation and comprehension simultaneously then production (SIM).

The results of this study indicated that the IM/COMP condition required fewest mean sessions to criterion and the "imitation then comprehension" sequence resulted in superior performance on production probes; the SIM condition resulted in greatest generalization; and the COMP/IM condition resulted in fewer articulation errors on criterion words during imitation training. The follow-up and production training results did not favor one condition over another.

In the following section, each of the five hypotheses will be discussed in light of the results of the present research. This section is followed by a discussion of theoretical implications, practical implications, limitations of the present study, and suggestions for future research.

Discussion of Hypotheses #1 - 5

Hypothesis #1 - Training comprehension before imitation (COMP/IM) will result in fewer total sessions to criterion for imitation and comprehension training and greater savings in instructional time than training the alternate sequence (IM/COMP).

The results of the present study did not support Hypothesis #1. Whitehurst (1977) and Ruder et al. (1977) examined training sequences involving imitation and comprehension training and concluded that comprehension training should precede imitation training. The present research found that the most efficient order in which to teach comprehension and imitation was - imitation, then comprehension (IM/COMP).

The discrepancy in results between this study and Whitehurst (1977), Ruder et al. (1977) may have been as a result of procedural and/or population differences.

(1) Procedural Differences - Whitehurst (1977) did not train imitation. In addition, training was conducted in only one sequence (modelling then comprehension). Finally, although Whitehurst (1977) supported the COMP/IM training sequence, the results of the normal modelling of direct-indirect object relationships indicated

that prior comprehension training was not necessary to produce production during production trials.

It is possible that the children in the Whitehurst (1977) study had difficulty with the reversed direct-indirect object condition since they had to unlearn a previously correct response before they could respond to the reversed condition. Perhaps comprehension training may not have been necessary for production to occur in the reversed condition if more modelling trials had been given following the reversal. It is difficult to determine if learning of the first form of direct-indirect object relationship (appropriate) interferred with acquisition of the second (reversed) since the two were never trained in the alternate sequence (reversed then appropriate).

Procedural differences may also account for the discrepancy between the results in the present sudy and those obtained by Ruder et al. (1977). Ruder et al. (1977) discouraged overt imitation during comprehension training. In the present study imitation during comprehension training was not discouraged, although teachers recorded each instance of imitation as it occurred. Covert imitation during comprehension may have occurred during comprehension training in either study. A second procedural difference involved imitation training with a referent object. The present study conducted imitation training with a referent object present. Ruder et al. (1977) conducted imitation training without the referent object being present.

Children in the present study were taught imitation with a referent object present and were not discouraged from imitating during comprehension training because the author wished to study the most efficient sequence of imitation and comprehension training under normal language training conditions. Under normal circumstances a teacher would not discourage imitation in a non-imitative handicapped child nor would he/she train imitation without a referent object being present. It may be concluded from the present research that under normal language training conditions, it is more efficient to train imitation first.

The data on delayed imitations during comprehension training did not support the suggestion made by Ruder et al. (1977) that imitation during comprehension training may affect the outcome of the study. The children emitted twice as many delayed imitations during the SIM condition, however, the SIM condition required the greatest mean sessions to criterion and did not result in superior performance on production probes.

(2) Population Differences - A second major difference between this study and the Whitehurst (1977) and Ruder et al. (1977) studies was the subject population. Whitehurst (1977) conducted his study with non-handicapped preschoolers. Ruder et al. (1977) conducted their study with non-handicapped 6 - 8 year olds.

The children in the present study were moderately to severely handicapped 3 - 5 year olds. It is possible that the discrepancy in results was obtained because of the difference in the linguistic development of the children and not as a result of the different procedures. Holdgrafer and McReynolds (1975) found that training language rules in one modality (auditory or speech) resulted in criterion performance in the untrained modality. In an attempt to explain the difference between their results and those obtained by Guess (1969) and Guess and Baer (1973), Holdgrafer and McReynolds (1975) suggested that whether or not facilitation occurs from the trained modality to the untrained modality may be a function of the linguistic development of the subjects studied.

The children in the present study were at a different linguistic level than those in the Whitehurst (1977) and Ruder et al. (1977) studies. Children were selected for the present study only if they were not generalized imitators. Baseline results indicated that the six children imitated a baseline word (either correct response or acceptable approximation) on the average less than 25% of the trials. Language data on non-handicapped indicates that normal children will attempt to imitate most single words long before 4 years of age (Caplan and Caplan, 1977). It is possible that children with a generalized imitation skill would reach criterion on the imitation instructional procedure more quickly than children who were just learning to imitate. This would result in the imitation instructional procedure being "easier" for the generalized imitators when compared with the non-generalized imitators.

In conclusion, the discrepancy in results between this study and those supporting the comprehension, then imitation, then production training sequence may have been as a result of procedural differences and/or differences in the population studied.

The population difference may also explain the discrepancy between the baseline results of the present study and the results of the studies by Fraser et al. (1972) and Fernald (1972). The studies by Fraser et al. (1972) and Fernald (1972) supported the IM/COMP training sequence, however, the baseline results in the present study indicated superior comprehension performance when compared with imitation performance. It is possible that children must reach a certain level of generalized imitation before comprehension performance exceeds imitation performance during a test for both. The children chosen for this study were not generalized imitators. This may account for superior performance on the comprehension task, since the imitation task would be more difficult for a non-generalized imitator than for a child with generalized imitation skills.

The production/comprehension studies suggesting that production training should precede comprehension training are considered support for the results of the present study (Cuvo and Riva, 1980; Keller and Bucher, 1979; Miller et al. 1977). Studies supporting the alternate sequence did not train both sequences, therefore, it is difficult to compare these studies with the present study. Asher (1972), Kohl et al. (1972), Mann and Baer (1971), Vasta et al. (1978) and Winitz and Reeds (1972) trained comprehension and noted an increase in production performance without direct training. These studies may have found the reverse to be true if they had trained production and probed comprehension.

In summary, the results of the present study are in agreement with other studies that support the expressive language (imitation) before receptive language (comprehension) strategy. The results did not support Hypothesis #1.

Hypothesis #2A - Criterion will be reached on production probes only after both imitation and comprehension training have occurred.

The results of the present study did not support Hypothesis #2A. The children did not require training in both imitation and comprehension instructional procedures before criterion was reached on production probes. Children reached criterion on 5/13 production probes without prior comprehension training and on 1/13 probes without prior imitation training. According to Ruder et al. (1977), the discrepancy in results between this study and his study may be explained in terms of procedural differences. In the present study, the imitation procedure contained elements of comprehension training (the referent object was present during training). In addition, the comprehension procedure contained elements of imitation training (the children were not discouraged from imitating). If one views the procedures in this light, then the children reaching criterion on production probes after only imitation training did experience a comprehension component. The same would be true for the one child who reached criterion on a production probe after only comprehension training.

In summary, the results of the present study did not support Hypothesis #2. It is possible that the procedure used in this study accounted for the difference in results between the present research and that conducted by Ruder et al. (1977).

Hypothesis #2B - Training comprehension before imitation (COMP/IM) will result in:

(1) a greater percentage of production probes reaching criterion; and

(2) a greater percentage of words trained in production reaching criterion within five sessions than the alternate sequence (IM/COMP).

The results of the present study did not support Hypothesis #2B. Ruder et al. (1977) found superior performance on production probes when comprehension preceded imitation training. He compared production probe data on the basis of average sessions to criterion and stability of production probe performance. All of his subjects reached criterion on all production probes. The children in the present study did not reach criterion on all production probes. They reached criterion on a greater percentage of probes when imitation training preceded comprehension training (with both the IM/COMP and SIM conditions combined). There was no difference in mean sessions to criterion for production probes among the three conditions in the present study. It was not possible to compare stability of performance on production probes. The production training data did not favor one condition over another.

It is possible that procedural and/or population differences may account for the discrepancy in results between the present study and Ruder et al. (1977) regarding production probes. It is unlikely that superiority of the IM/COMP sequence on production probes in the present study can be attributed to imitation during comprehension training. Children in this study emitted delayed imitations twice as often in the SIM condition, however, children in the SIM condition did not exhibit superior performance on production probes. It is possible that population differences and not procedural differences were the crucial factors in determining which sequence resulted in greater performance on production probes.

In summary, the results of the present research did not support Hypothesis #2A. Children showed better performance on production probes when training on the words was conducted with imitation preceding comprehension. There was no difference in the production training data as a result of condition. As with the previous two hypotheses (1, 2A), the discrepancy between the results obtained in the present study and those of Ruder et al. (1977) may have been due to procedural differences and/or to differences in population.

Hypothesis #3 - The order of imitation and comprehension training (IM/COMP; COMP/IM or SIM) will not affect follow-up results.

The results of the present study support Hypothesis #3. Review and Maintenance data did not favor one condition over another. These results are supported by Cuvo and Riva (1980) and Miller et al. (1977). They are not supported by Cuvo et al. (1980).

Cuvo et al. (1980) found increased retention following simultaneous presentation of items. The retention tests were conducted immediately after training. Cuvo et al. (1980) suggested that simultaneous presentation might also result in increased long term follow-up (1-4 weeks). The SIM condition in the present study did not support the hypothesis made by Cuvo et al. (1980). Further research would be necessary in order to determine if the simultaneous procedures used by Cuvo et al. (1980) would indeed result in greater long-term follow up.

Hypothesis #4 - Simultaneous presentation of imitation and comprehension training (SIM) will result in increased generalization performance (higher percent correct responses) than sequential presentation of imitation and comprehension (IM/COMP and COMP/IM).

The results of the present study supported Hypothesis #4 and previous relevant studies (shroeder and Baer, 1972; Panyon and Hall, 1978). Although the group generalization data did not indicate much difference in generalization among the three conditions, the individual child data showed increased generalization performance in the SIM condition for object, setting and teacher with all children, but S4. The generalization performance of S4 may have been affected by the numerous absenses of S4 during the COMP/IM condition for medical reasons (See Appendix C-S4 data). He required fewer sessions to criterion in the COMP/IM condition when compared with the SIM condition, however, he spent twice as many months in the COMP/IM condition than in the SIM condition. The additional time spent in the COMP/IM condition may have resulted in greater opportunities for the responses learned during language sessions to occur outside the language training session and be reinforced.

The effect of the SIM condition on generalization was strongest for generalization to setting and to teacher. In these generalization tests, only one dimension was changed (the location of the trial or the individual conducting the trial). These changes were constant over all conditions. The effect of the SIM condition on generalization was weakest for generalization to object. In this generalization test, the physical characteristics for each object were changed along at least two dimensions. It was not possible to conclude that the generalization objects for one condition were more or less difficult than those in the other conditions. The difficulty in equating the "generalization to object" tests for the three conditions may have resulted in the SIM condition showing less of an effect on this type of generalization.

Correct responses during generalization tests in a different setting were not consequated with primary reinforcers. In contrast, correct generalization responses to a different object and different teacher did result in primary reinforcement. The absense of primary reinforcers in the "generalization to setting" tests did not result in a lower percent correct when compared with the other two generalization gests.

In summary, this study supported the hypothesis that the SIM condition would result in better generalization than the sequential conditions.

Hypothesis #5 - Comprehension training preceding imitation training (COMP/IM) will result in a smaller percentage of articulation errors (determined through error analysis) for criterion words in imitation.

To some extent, the results of this study did support Hypothesis #5. Children in the COMP/IM condition had a greater percentage of correct criterion responses following imitation training. The COMP/IM condition did not result in more substitutions (judged as the most acceptable error), or fewer construction errors (judged as the least acceptable error).

Mann and Baer (1971) suggested that improved articulation following comprehension training may not occur with non-imitative children. All of the subjects in the Mann and Baer 1971 study were imitative. Perhaps the results of this study would have indicated stronger support for Hypothesis #5 (i.e. more substitution errors and fewer combination errors for words taught with prior comprehension training)if the children in this study had been generalized imitators.

In summary, the results of this study did support Hypothesis #5 to some extent. There was a greater percentage of correct responses reaching criterion during imitation training when the words were first trained in comprehension. There was no difference in the error analysis to indicate a higher level of articulation error when comprehension training preceded imitation training.

Section Summary. The results of this study were discussed in terms of the five hypotheses. It was suggested that discrepancies in results obtained in the present study and those obtained by Ruder et al. (1977) may have been due to procedural and/or population differences. In contrast, with the results of Ruder et al. (1977), the results of the present study support the "imitation then comprehension" training sequence. This sequence resulted in fewer sessions to criterion and superior performance on production probes, (the two dependent measures in the Ruder et al. (1977) study).

The only dependent measure on which the COMP/IM sequence proved superior was in the error analysis. The COMP/IM condition resulted in a greater percentage of correct criterion words following imitation training. This would not result in a savings in instructional time since approximations were accepted as correct responses as long as they were consistent and used to label a single object.

The SIM condition resulted in the greatest generalization, however, in terms of overall instructional savings, this condition was not as efficient as the IM/COMP sequence. Children in the SIM condition required the greatest mean sessions to criterion and this condition did not result in superior performance on production probes. In addition, children in the SIM condition experienced difficulty in reaching criterion on both imitation and comprehension for the word pairs.

The results of the present study favor the IM/COMP condition as the condition resulting in the greatest overall savings in instructional time.

Theoretical Implications

The major focus of this study was an investigation of the most efficient way to teach imitation and comprehension of one and two-syllable nouns. This touched on at least two theoretical questions:

(1) Does production (expressive language) precede comprehension (receptive language) or does comprehension precede

production?

(2) What is the best logic that one might use to sequence program content - developmental or remedial?

Both theoretical issues are discussed below.

(1) Does production (expressive language) precede comprehension (receptive language) or does comprehension precede production?

The question "what comes first receptive or expressive language?" has been discussed at length (Bloom, 1974; Chapman, 1974; Ingram, 1974) and is still far from being settled (McLean and Snyder-McLean, 1978).

A major problem in settling this question seems to be the lack of a common definition for receptive language (Bloom, 1974). It is fairly easy to determine when an individual begins to express himself verbally. It is far more difficult to determine an individual's receptive language skills unless you arbitrarily decide on a response that demonstrates receptive language skills. For example, the present study defined receptive language (comprehension) in terms of a four-choice discrimination task.

Whitehurst (1977) claimed that individuals first learn to attend to certain parts of words or phrases, then selectively imitate those portions he/she has attended to, and finally learns to produce the utterance spontaneously (CIP hypothesis). Whitehurst (1977) emphasized that the "comprehension" in the CIP hypothesis was more than just discrimination training as was investigated in this Study. Whitehurst (1977) identified at least three procedures by which comprehension may develop: Simple observational learning, observational learning with responding in the receptive mode and observational learning with responding in the productive mode. The "comprehension" in the CIP hypothesis refers to a discriminative ability, not a particular method of acquiring that ability. In behavioral terms, the individual may demonstrate receptive language skills by emitting a number of different responses (e.g. looking at an object when it is labelled by another, pointing to an object on the request "Show ____", etc.). An individual may not be trained on a receptive task, however, this does not rule out the possibility of receptive training by another means (e.g. observational learning with responding in the productive mode).

The results of the present study favored the expressive (imitation) then receptive (comprehension) training sequence. The fact that this sequence was the most efficient for training purposes does not rule out the possibility that there was comprehension training on items before comprehension was formally trained. Ruder, et al. (1977) attempted to eliminate the possibility of inadvertent comprehension training during imitation by training imitation without the referent object present. The present study did not train imitation without the referent object, therefore, there are elements of comprehension training within the imitation training procedure.

In conclusion, the results of this study do not answer the question "What comes first receptive language (comprehension) or expressive language (production)?" They do suggest, however that training should proceed in the sequence - expressive language (imitation) with a referent object present then receptive language (comprehension). The theoretical debate will probably continue indefinitely unless someone comes up with a definition of receptive language that would satisfy everyone. At this point in time, receptive language means different things to different people and the debate goes on.

(2) What is the best logic that one might use to sequence language program content - developmental or remedial?

The developmental vs remedial logic controversy is another theoretical issue pertinent to the present study. The results of this study would support a remedial logic to language program sequencing. Developmentally, the children in this study appeared further advanced in the comprehension of nouns than in imitation, and in imitation than production. The children made more correct responses on the baseline in comprehension than in imitation, and in imitation than production. A developmental logic would suggest that "normal" language development proceeds in this sequence, therefore skills should be taught in the sequence - comprehension followed by imitation and production.

On the other hand, remedial logic would favor the reversed sequence of imitation and comprehension training. Remedial logic favors expressive language training prior to receptive language training. Guess et al. (1978b) analyzed the trials to criterion for the steps in their language program, and found that it was more efficient to teach the expressive language items first (e.g. production of nouns prior to comprehension training on the same nouns). In addition, the sequence production then comprehension gives the child more functional control over his/her environment more quickly. A child who verbalizes can be much more effective in his/her environment than a child who points.

In conclusion, the results of this study favor an "imitation then comprehension" training sequence and support the remedial logic to language program sequencing previously discussed.

Practical Implications

The results of the present research suggest that lexical items be trained with imitation training preceding comprehension training. This sequence resulted in the greatest savings in instructional time when compared to the alternate sequence. The COMP/IM training sequence did result in a greater percentage of correct criterion words during imitation training, however, the sequence required greater sessions to criterion and did not result in superior performance on production probes.

The SIM condition was not as efficient as the IM/COMP condition on a number of measures (e.g. sessions to criterion; production probe data). It is possible that the children would have been more successful in this condition if the same words had been trained simultaneously in comprehension and imitation. In the present study, it was necessary to train one word pair in imitation and a different word pair in comprehension thus requiring mastery of four words rather than two words. The SIM condition taught in this fashion resulted in the greatest mean sessions to criterion. In addition, children taught in this particular condition experienced the most difficulty reaching criterion in both imitation and comprehension on both word pairs. Although the SIM condition resulted in the greatest generalization, the difficulty the children experienced in this condition would not favor the use of this procedure as it was carried out in the present study.

In summary, results of this study favor the training sequence-imitation followed by comprehension rather than the alternate sequence. It is possible that simultaneous presentation of training items might be a more efficient method of teaching _if_ the same items are taught in both imitation and comprehension. This question is open to further research.

Limitations of the Study

This study had two major limitations:

(1) length of experimental conditions and failure of all children to complete all three conditions;

(2) difficulty with selection of training items.

The first limitation was the length of time that children spent in the experimental condition. The frequent absences of the children resulted in gaps of five or more days between sessions. It is possible that child's performance in a particular condition may have been affected by these absences, however, the individual word data (see Appendix D) reveals that child absences of greater than five days were fairly evenly distributed among the conditions with the exception of S4.

The length of the experimental condition resulted in summer breaks occurring within conditions and between conditions. Again, this may have affected child performance in this study. It is difficult to determine how this limitation could have been avoided. The children required hospitalization for pneumonia and related problems on a number of occasions and sessions were conducted when the children were present at school. Perhaps the children could have been given more than one language session on the days on which they were present.

The teaching procedure used in this study may have been partly responsible for the length of the experimental condition. Olenick and Pear (1980) found that primary reinforcement of prompted trials resulted in more sessions to criterion when compared with trials on which only correct responses resulted in primary reinforcement. Children in the present study were given primary reinforcement on prompted trials (correction procedure) as well as correct responses. It is possible that this resulted in children taking longer to complete the experimental condition.

The second limitation of the present study was the difficulty with selection of training items. It was extremely difficult to select nouns that were considered "functional" for the child and equate the nouns in the word pools for sound characteristics as well as physical characteristics of the referent objects. It would have been simpler to compare nonsense words and assign contrived referent objects. The author preferred to keep the training tasks under investigation as close as possible to a normal language training situation.

In summary, there were two major limitations in this study. Both may have resulted from attempts made by the author to keep the experimental conditions and training procedures consistent with those used during "normal" language sessions. The children were given their language sessions in the same manner and on the same schedule as other children in the Early Education Program. The procedures were intended to maximize the probability of teaching functional language skills to moderately/severely handicapped preschoolers.

Suggestions for Future Research

The present study indicates a number of areas for future research. The subjects in this study were all preschool retarded children. It would be interesting to replicate the study with older handicapped individuals at the same general level of language ability. In addition, the study could be replicated with a wide variety of language deficient children at different ages and with different handicapping conditions to determine if one sequence is most efficient regardless of age or handicapping condition.

The task used in this study (noun identification) could be expanded to include other lexical items (e.g. verbs) and more complex utterances. It is possible that transfer between expressive and receptive language is dependent upon the difficulty of the task (Cuvo et al. 1980).

Finally, it would be important to compare simultaneous presentation of imitation and comprehension with the same word pairs and the two sequences of imitation and comprehension training. This procedural change may result in the same or fewer sessions to criterion for imitation and comprehension as well as greater generalization in the SIM condition.

The results of the present study are seen as one small attempt at language program sequence validation. It is hoped that future research will allow teachers to use "packaged" language programs and be confident that the sequencing of the program will result in development of functional language skills with a nimimum amount of instructional time.

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APPENDIX A

PRETEST RESULTS

APPENDIX A

DESCRIPTION OF THE PRETEST

Teachers in the Early Education Program were asked to identify children who could imitate a minimum of two words (approximiations or correct responses), point to at least two different objects in a four-choice discrimination task, but did not label objects in response to the question "What's that?"

These children were administered the pretest for this study. The author asked the teachers to identify five objects for each child and to include any items representing nouns that the child had previously attempted to imitate.

This author tested each of the children on the five nouns in imitation, comprehension and production on three separate occasions (as defined in the Method section). The order of testing of imitation, comprehension and production was changed for each of the three pretests. The pretest was conducted in the same manner as the Baseline using the same definitions and scoring criteria.

A child was selected for the present study if he/she demonstrated the following skills:

(1) Child imitated (correct response or acceptable approximation) at least two out of the five nouns presented on 2/3 trials;

(2) Child pointed to at least two of the five objects representing the nouns on 2/3 trials;

(3) Child did not make a correct response or an acceptable approximation following the question

"What's that" for the same noun on 2/3 trials.

Children who met the above criteria were selected for this study and preceded to the Baseline condition.

S1, S3, and S6 made 3/5 correct responses (or acceptable approximations) in imitation and comprehension. S2 made 2/5 correct responses (or acceptable approximations) in imitation and 3/5 correct responses in comprehension. S4 and S6 made 2/5 correct responses (or acceptable approximations in both imitation and comprehension.

Two additional children proceeded to the Baseline and began the study. One child left the program prior to the completion of the first instructional procedure in the IM/COMP condition and was replaced by S1. The second child was eliminated from the study prior to completing the first condition as she became very ill and stopped all verbal imitation, after a lengthy period in the hospital. She was replaced by S5.

Four children were eliminated from this study following the Pretest, as they did not meet the three criteria previously stated.

APPENDIX B

BASELINE LISTS

Appendix B

Nouns Used in the Baseline Procedure

List 1	
pants	(1)
spoon	(2)
horse	(3)
gun	(3)
mitt	(1)
pot	(3)
block	(3)
record	(3)
bead	(4)
baby	(3)
plane	(3)
boat	(3)
knife	(2)
orange	(5)
towel	(4)
soap	(4)

List 2	
boot	(1)
comb	(4)
ring	(3)
purse	(1)
bus	(3)
doll	(3)
teddy	(3)
pencil	(4)
bell	(3)
train	(3)
phone	(3)
brush	(4)
bike	(3)
bow	(3)
crayon	(4)
sock	(1)

List 3	
tape	(4)
zipper	(4)
grapes	(5)
flower	(4)
thread	(4)
sponge	(4)
dress	(1)
scarf	(1)
ring	(4)
barret	(1)
ruler	(4)
lemon	(5)

(1) - Clothing
(2) - Utensils
(3) - Toy
(4) - Teaching Material
(5) - Food

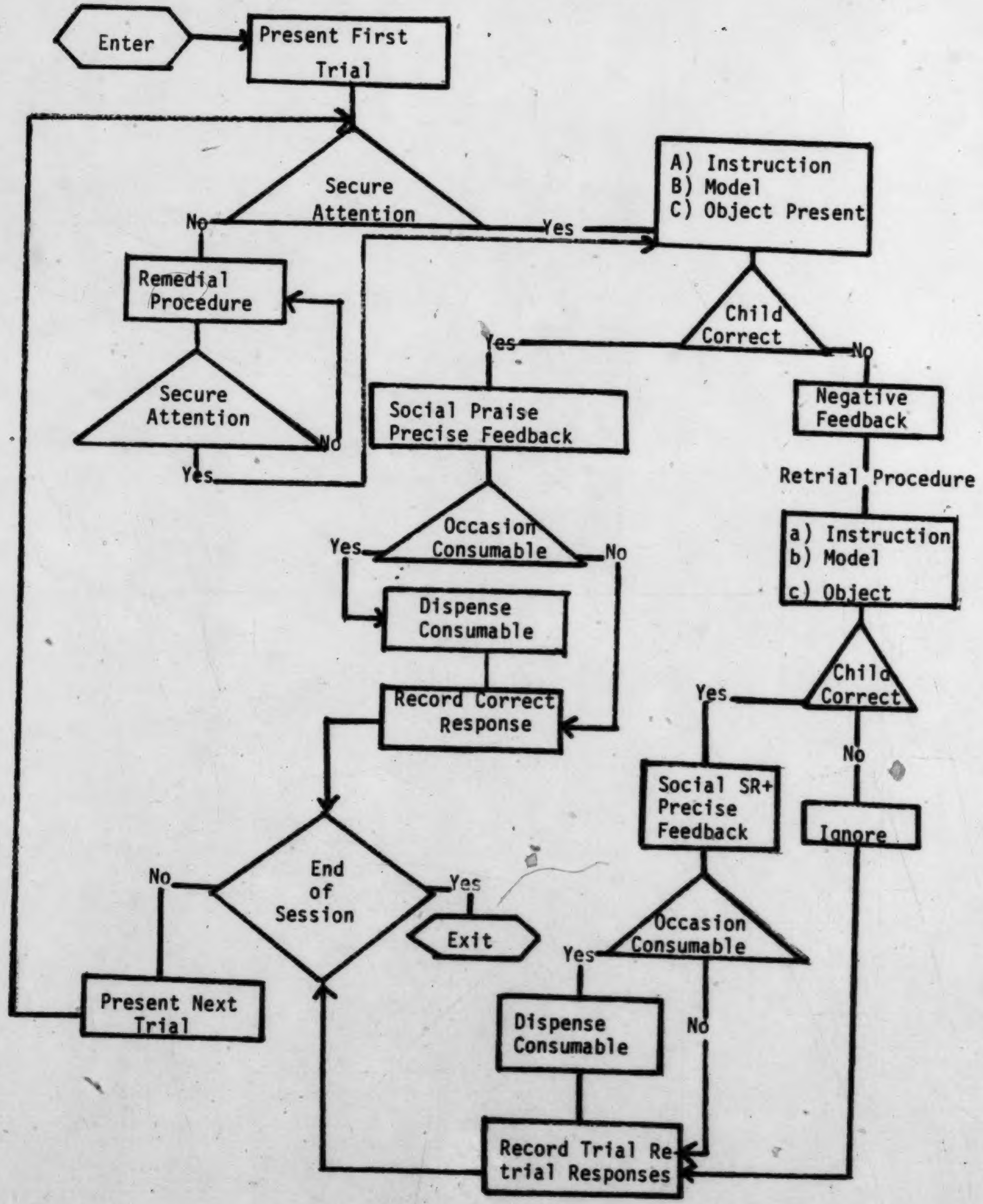
APPENDIX C

INSTRUCTIONAL PROCEDURE FLOW CHARTS

(IMITATION, COMPREHENSION, PRODUCTION)

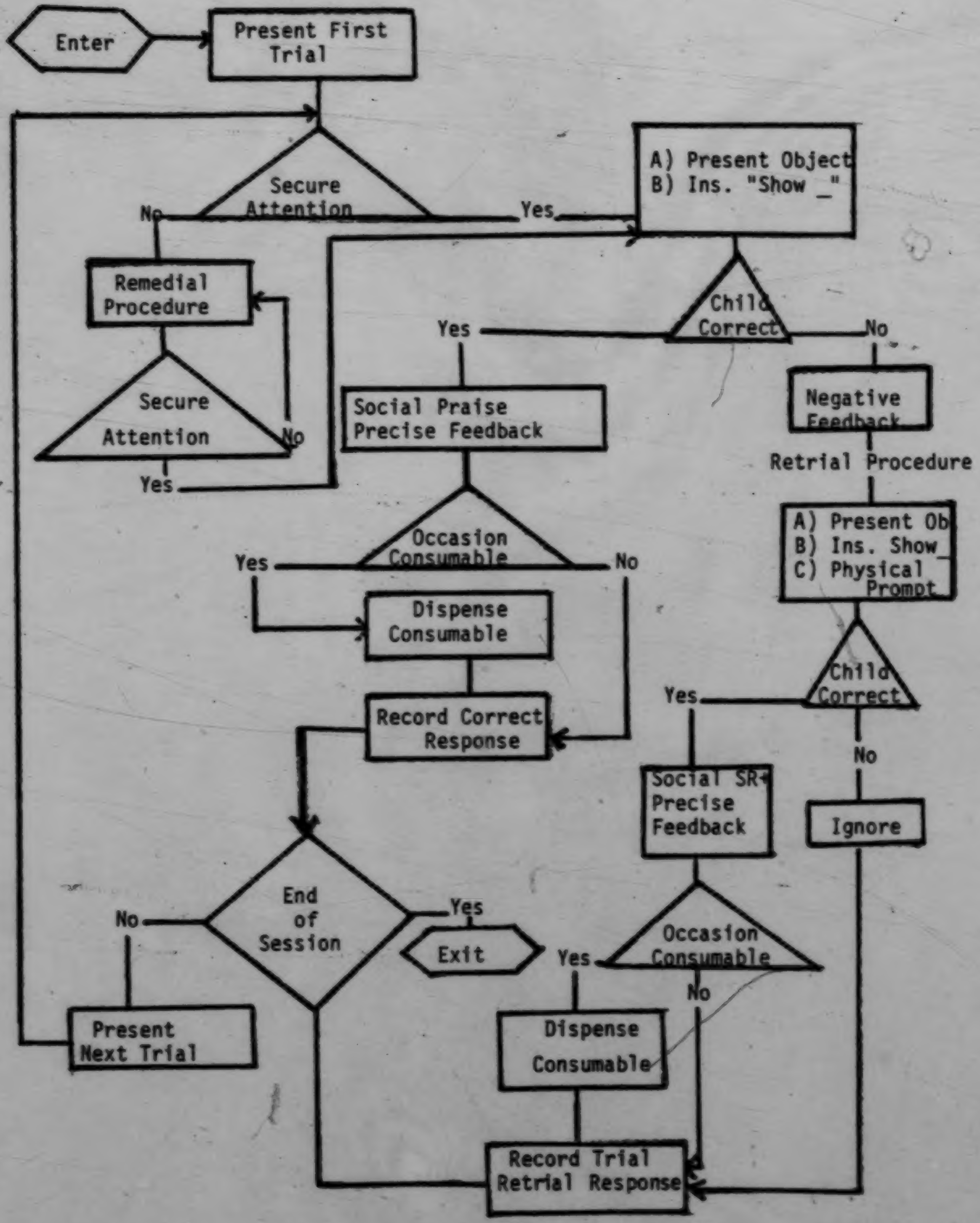
APPENDIX C

IMITATION INSTRUCTIONAL FLOWCHART


Enter
Present First Trial
Secure Attention
No
Yes
A) Instruction
B) Model
C) Object Present
Remedial Procedure
Secure Attention
No
Yes
Child Correct
Yes
No
Social Praise
Precise Feedback
Negative Feedback
Retrial Procedure
Occasion Consumable
Yes
No
a) Instruction
b) Model
c) Object
Dispense Consumable
Record Correct Response
Child Correct
Yes
No
Social SR+
Precise Feedback
Ignore
End of Session
No
Yes
Exit
Occasion Consumable
Yes
No
Present Next Trial
Dispense Consumable
Record Trial Retrial Responses

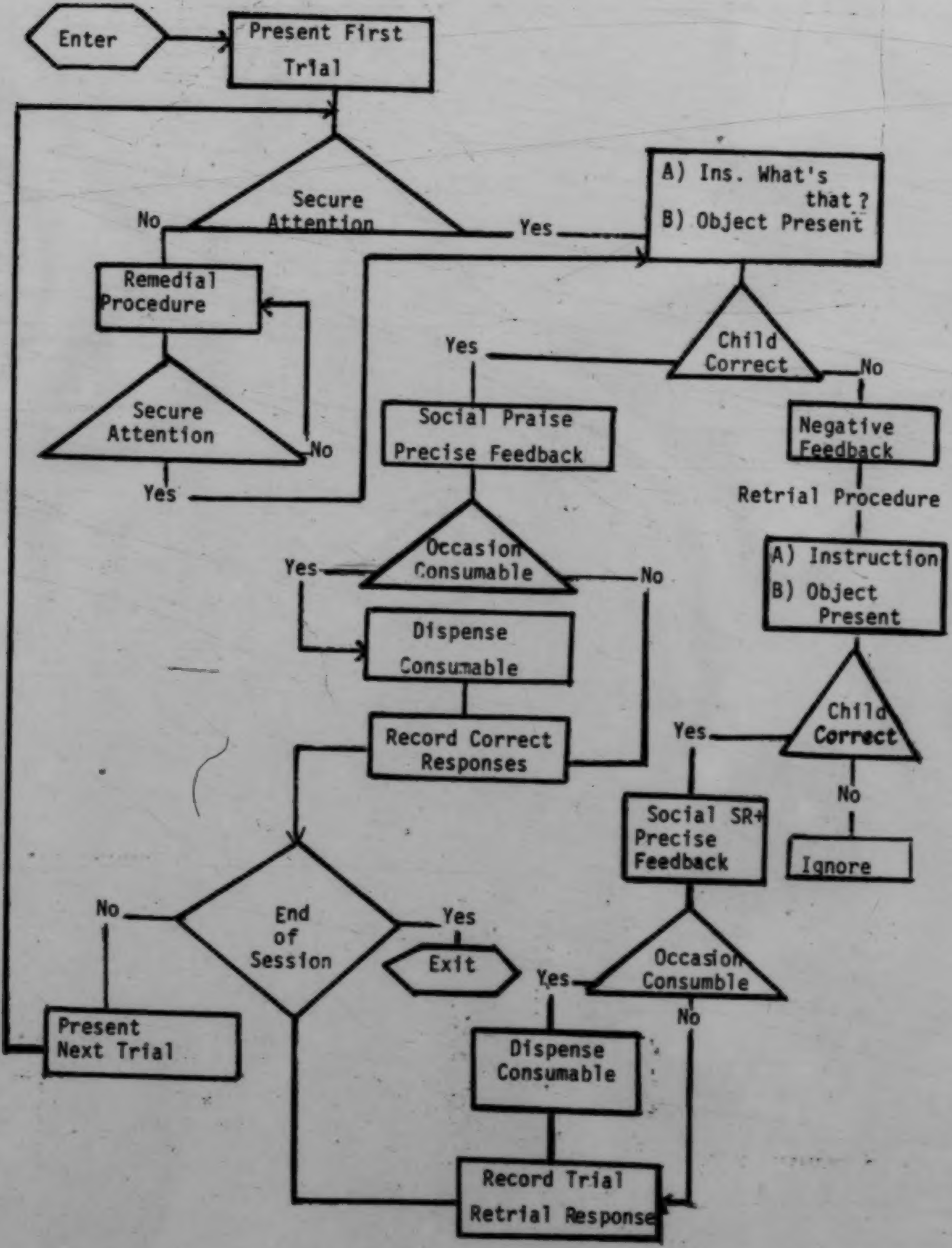
APPENDIX C

COMPREHENSION FLOW CHART


Enter
Present First Trial
Secure Attention
No
Yes
A) Present Object
B) Ins. "Show _"
Remedial Procedure
Secure Attention
No
Yes
Child Correct
Yes
No
Social Praise Precise Feedback
Negative Feedback
Retrial Procedure
Occasion Consumable
Yes
No
A) Present Ob
B) Ins. Show_
C) Physical Prompt
Dispense Consumable
Record Correct Response
Child Correct
Yes
No
Social SR+ Precise Feedback
Ignore
End of Session
No
Yes
Exit
Occasion Consumable
Yes
No
Present Next Trial
Dispense Consumable
Record Trial Retrial Response

APPENDIX C

PRODUCTION INSTRUCTIONAL FLOWCHART


Enter
Present First Trial
Secure Attention
No
Yes
A) Ins. What's that ?
B) Object Present
Remedial Procedure
Secure Attention
No
Yes
Child Correct
Yes
No
Social Praise
Precise Feedback
Negative Feedback
Retrial Procedure
Occasion Consumable
Yes
No
A) Instruction
B) Object Present
Dispense Consumable
Record Correct Responses
Child Correct
Yes
No
Social SR+
Precise Feedback
Ignore
End of Session
No
Yes
Exit
Occasion Consumble
Yes
No
Present Next Trial
Dispense Consumable
Record Trial Retrial Response

APPENDIX D

INDIVIDUAL WORD DATA

S1 - S6

Appendix D

Explanation of Individual Word Graphs

Individual Data for S1 - Sessions in the IM/COMP condition began during the 1978/79 school term and were completed by the end of the term. During imitation training, the word "soap" was replaced by the word "mitt" as the teachers found it difficult to discriminate S1's approximations for the two words after four sessions. This resulted in the word "soap" replacing the word "mitt" for the second word pair. No problems were encountered for either word pair during comprehension training. S1 reached criterion on one of the word pairs during production training.

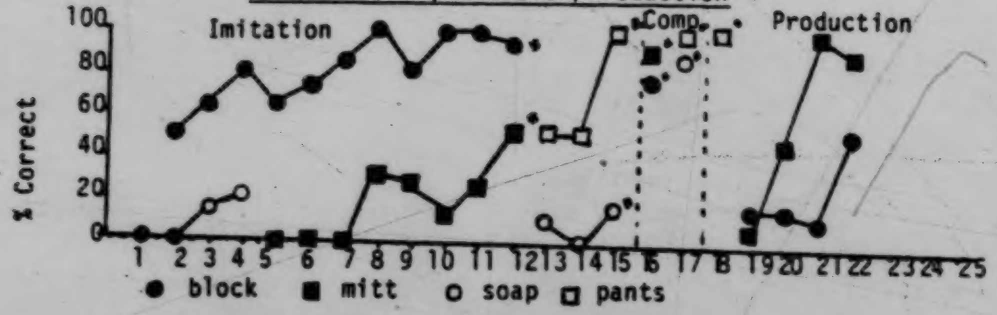
S1 completed the COMP/IM and SIM conditions during the 1979/80 school term. In the COMP/IM condition, the word "ring" was discontinued during imitation training after five consecutive days without a correct response or an acceptable approximation. Since S1 did not reach criterion on the word pair "comb/ring" during imitation training, no production training was given on this word pair.

S1 reached criterion on both word pairs in imitation and comprehension training during the SIM condition. S1 may have reached criterion on both word pairs in production training, however the end of the 1979/80 school term was reached before the last three sessions in production could be given. S1 did reach criterion on the word pair "sponge/barret" in production, however, it turned

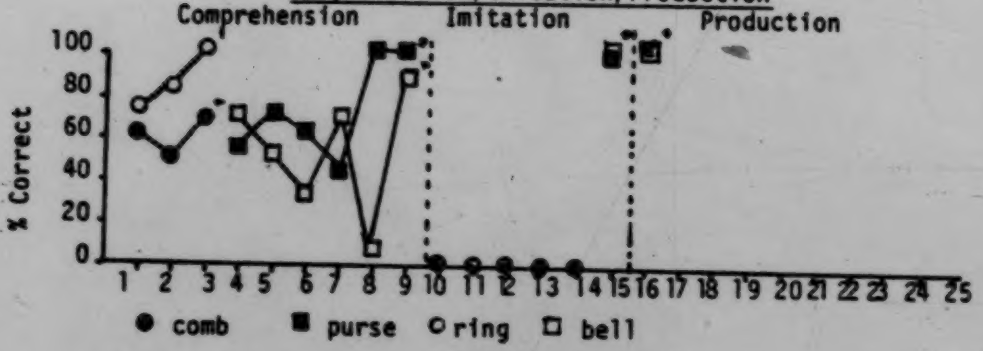
Appendix D

S1 Individual Word Data

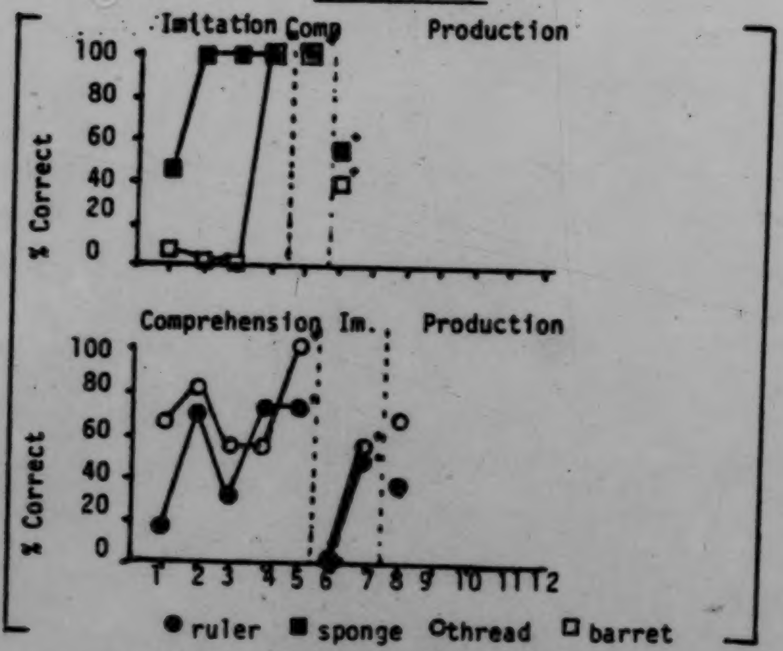
Imitation/Comprehension/Production



Comprehension/Imitation/Production



Simultaneous



* - 12 consecutive correct responses

out that production training for this word pair had not been necessary since both words reached criterion during production probes.

S1 suffered a number of upper respiratory infections over the course of this study and was often absent. There were five absences of more than five days during the IM/COMP condition, four during the COMP/IM condition, and four during the SIM condition. Absences of more than five days occurred between the following sessions:

(1) IM/COMP - 1-2; 4-5; 6-7; 7-8; 10-11,
(2) COMP/IM - 1-2; 6-7; 7-8; 13-14,
(3) SIM - 1-2; 2-3; 3-4; 7-8.

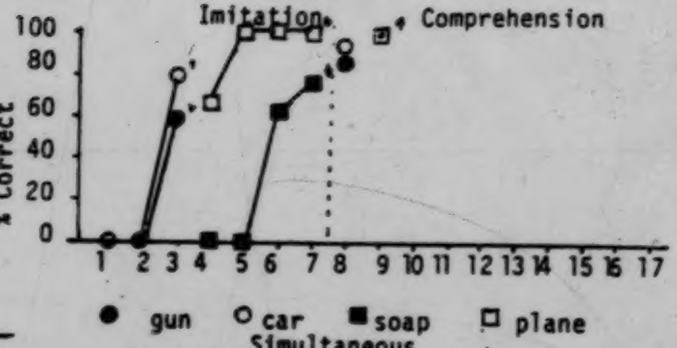
Individual Data for S2 - S2 completed the IM/COMP and SIM conditions during the 1978/79 school term. No problems were encountered during the IM/COMP condition. Production training was not necessary for either word pair as S2 reached criterion on all four words during production probes.

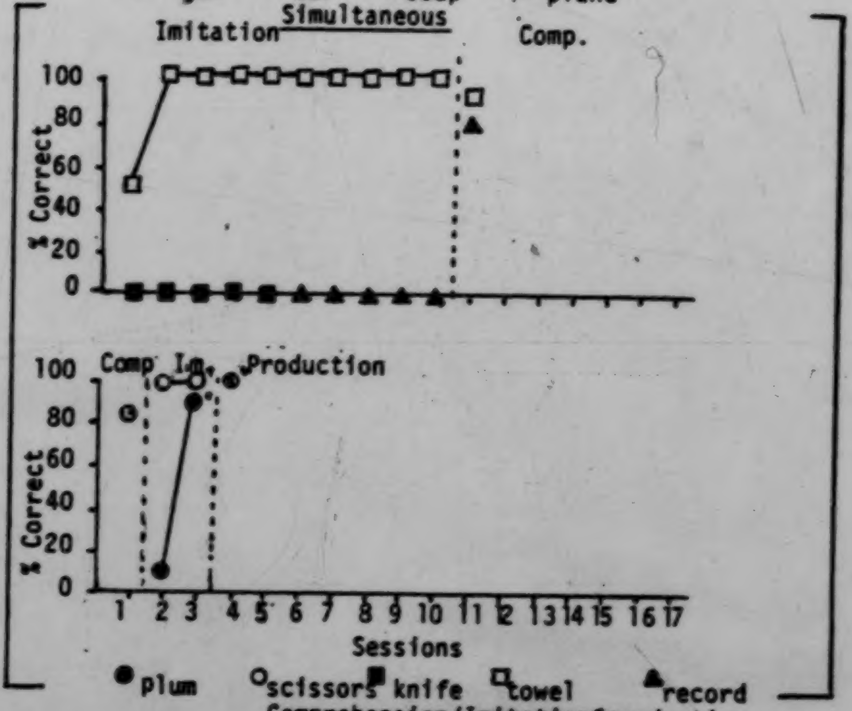
During the SIM condition, S2 responded at 100% correct on the word "towel" after the first session, however, she was not able to reach criterion on two other words (knife and record) that were paired with "towel". Both "knife" and "record" were discontinued after five days of imitation training without a correct response or an acceptable approximation. The word pair "towel/record" reached criterion in comprehension training in one session. No production training was given on this word pair since criterion was

Appendix D

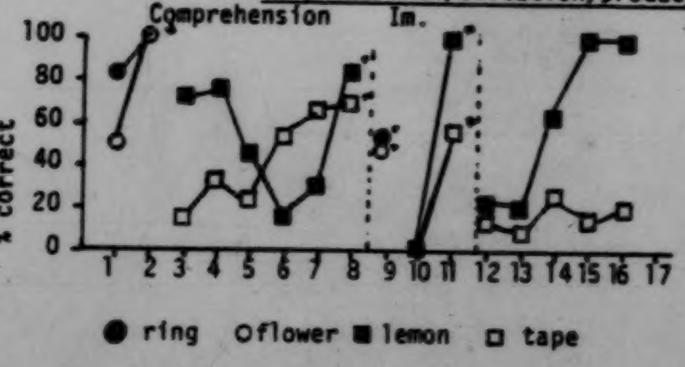
S2 - Individual Word Data

Imitation/Comprehension/Production





Comprehension/Imitation/production



Key

* 12 consecutive correct responses

not reached during imitation training.

No problems were encountered with the COMP/IM condition. The teachers gave all production sessions for one of the word pairs (lemon/tape). The teachers had been requested to change the word pair in production training after the third session if criterion had not been reached so that both word pairs would receive some sessions in production training.

S2 was absent for more than five days more frequently in the last condition (COMP/IM) than in the first two conditions. This could explain the fact that S2 (unlike the other children) required more sessions to criterion for the last condition than the first condition (see Figure 3). Absences of more than five days occurred between the following sessions:

(1) IM/COMP - 1-2; 8-9,

(2) SIM - 1-2; 4-5,

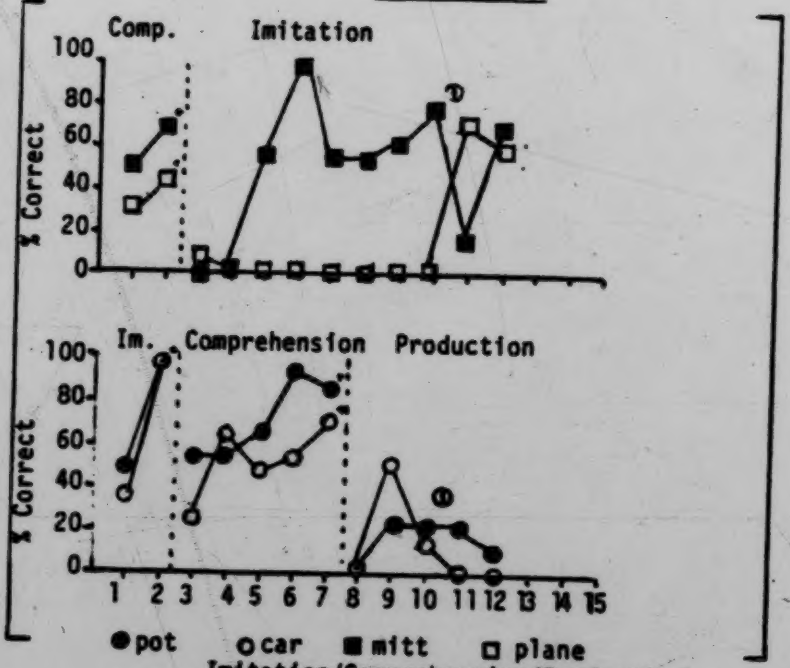
(3) COMP/IM - 2-3; 3-4; 5-6; 13-14.

Individual Data for S3 - S3 began the SIM condition in the 1978/79 school term and resumed sessions in the 1979/80 term. The teachers conducted a baseline on the two word pairs at the start of the 1979/80 term. It was found that S3 had maintained the word pairs on which she had already reached criterion and she had not acquired "mitt/plane" in imitation or "pot/car" in production over the summer. Sessions on "mitt/plane" in imitation were discontinued after 10 sessions without criterion having been reached. This word pair was not trained in production since criterion was not reached

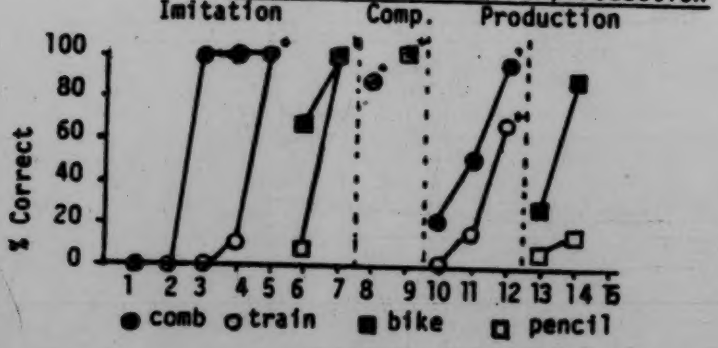
Appendix D

S3 - Individual Word Data

Simultaneous



Imitation/Comprehension/Production



Key

+ - 12 consecutive correct responses

Ⓢ - Summer holidays

during imitation training. Sessions on "pot/car" were discontinued after five sessions in production without criterion being reached.

No problems were encountered during the IM/COMP condition. S3 was not able to reach criterion on both word pairs in production within five sessions.

S3 experienced numerous upper respiratory problems over the course of this study requiring hospitalization. There were 11 absences greater than five days during the SIM condition and seven absences of greater than five days during the IM/COMP condition. Absences of greater than five days occurred between the following Sessions:

(1) SIM - all sessions;

(2) IM/COMP - 1-2; 2-3; 3-4; 6-7; 7-8; 9-10; 12-13.

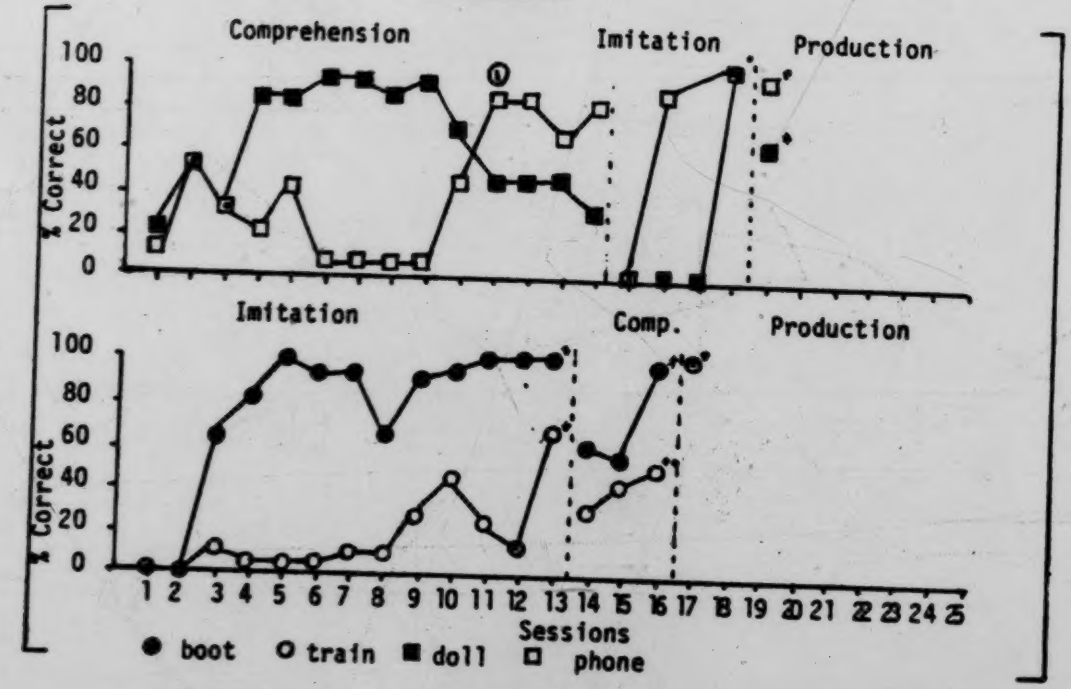
Individual Data for S4 - S4 completed the SIM condition and part of the COMP/IM condition during the 1978/79 school term. In the SIM condition, S4 experienced difficulty with the word "phone" during imitation training. During Session #10, the teachers were instructed to give trials on only the word "phone". In subsequent sessions, S4's performance on "phone" improved, however, his performance on "doll" dropped off.

S4 should not have been given production training on the "doll/phone" since he had not reached criterion during imitation. The teachers gave one session in production following comprehension training and S4 reached criterion on the word pair during this session. S4 reached criterion on the second word pair in imitation, compre-

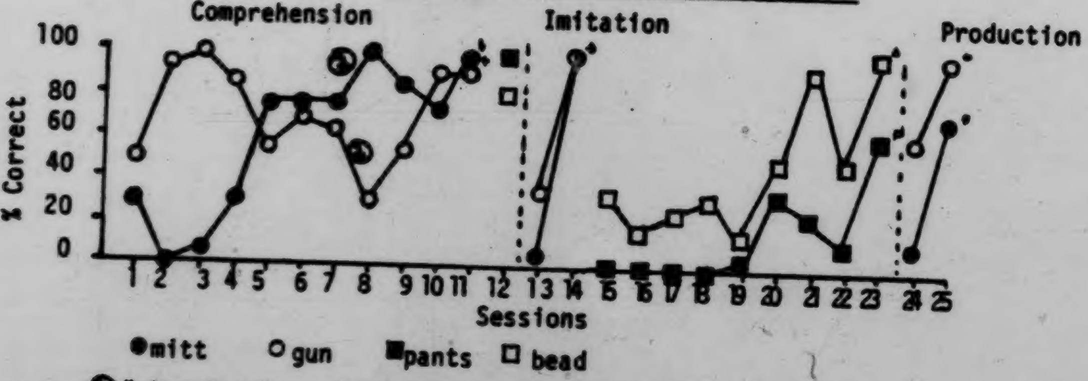
Appendix D

S4 - Individual Word Data

Simultaneous



Comprehension/Imitation/Production



① "phone" only - (this says "phone" only)
② Summer holidays
* 12 consecutive correct responses

hension and production without problem.

Sessions in the COMP/IM condition were interrupted between sessions seven and eight by summer holidays. The teachers conducted a baseline on both word pairs prior to session eight. S4 had not acquired the words in imitation, comprehension or production over the summer holidays, therefore sessions were continued. Production training on the two word pairs was not completed as the end of the school term was reached before the last three sessions could be given.

S4 missed quite a bit of school due to upper respiratory infections and operation on his legs. S4 had ten absences of greater than five days in the COMP/IM condition and four in the SIM condition. Absences of greater than five days occurred between the following sessions:

(1) SIM - 3-4; 6-7; 8-9; 9-10;
(2) COMP/IM - 4-5; 7-8; 8-9; 10-11; 11-12; 14-15; 15-16; 16-17; 17-18; 21-22.

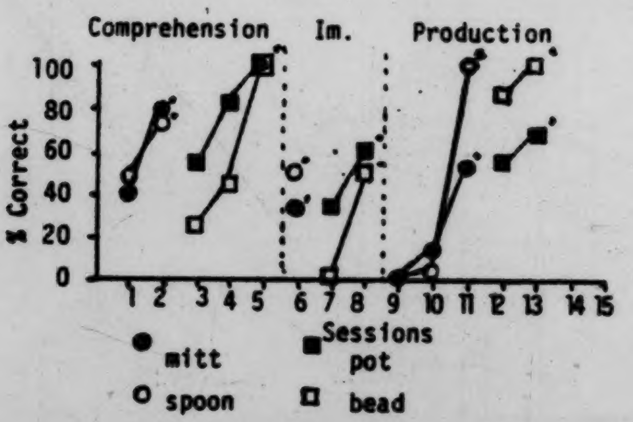
Individual Data on S5 - S5 completed the COMP/IM and IM/COMP conditions during the 1979/80 school term with no problems encountered. Since S5 began sessions later than the other children and was moving to a new program, it was not possible to complete the last condition.

Individual Data on S6 - S6 completed only one experimental condition (COMP/IM)and was eliminated from this study when she began to spontaneously produce words after the Christmas break.

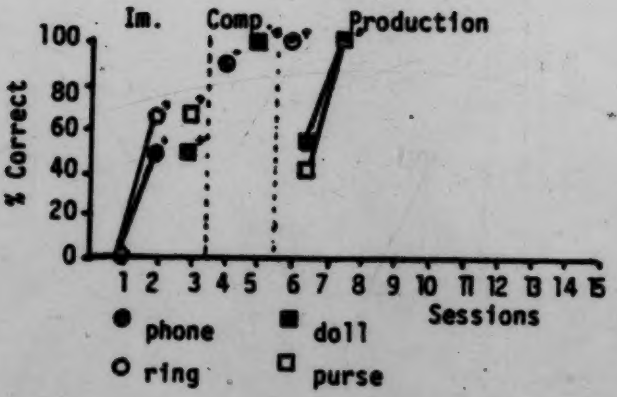
Appendix D

S5 - Individual Word Data

Comprehension/Imitation/Production



Imitation/Comprehension/Production



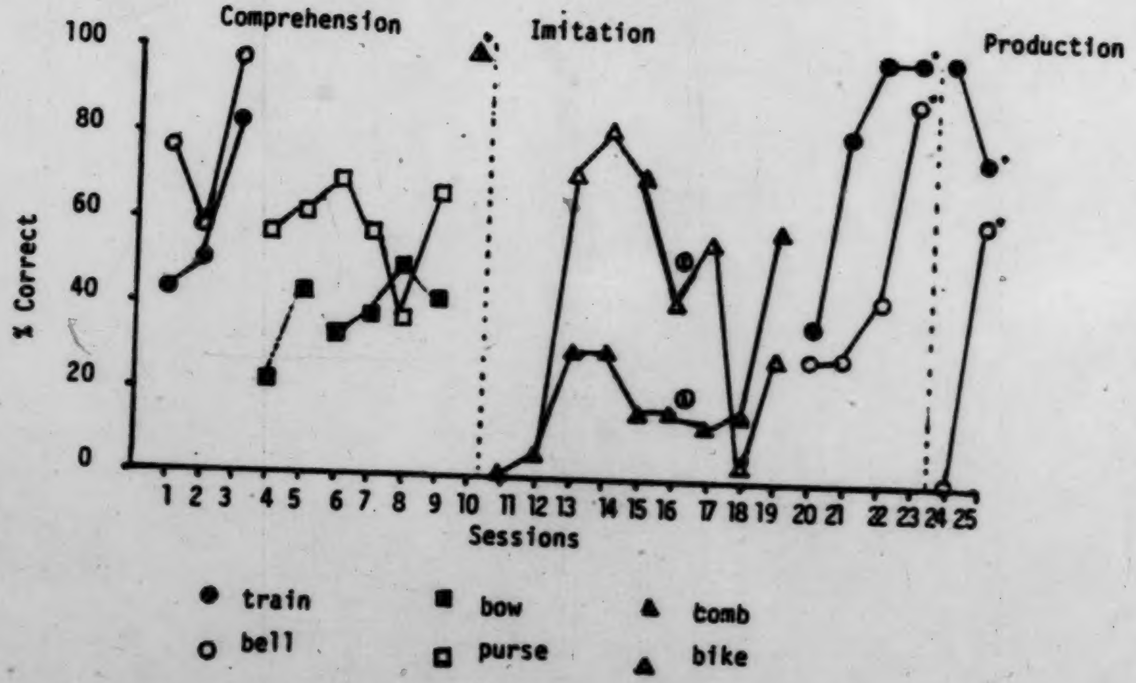
Key

* - 12 consecutive correct responses

Appendix D

S6 - Individual Word Data

Comprehension/Imitation/Production



Key

① - summer holidays
* - 12 consecutive correct responses

S6 reached criterion on "train/bell" in comprehension, imitation, and production. She was not able to reach criterion on "bow/purse" in comprehension, therefore, two other words (comb and bike) were substituted in the 10th session. Although these two words were eligible from the baseline results, S6 scored 100% correct on the word pair in the first session in comprehension and proceeded to imitation.

Sessions on "comb/bike" in imitation were interrupted following session 16 by summer holidays. The teachers conducted a baseline on the two word pairs in the fall before sessions were resumed. S6 had maintained "train/bell" and "comb/bike" in comprehension and had not acquired either word pair in imitation or production over the summer. Sessions were resumed on "comb/bike" in imitation and were discontinued after nine sessions without criterion being met (the teachers should have continued for 10 sessions). Sessions were not conducted on "comb/bike" in production as S6 did not reach criterion on this word pair in imitation.

S6 had 11 absences of more than five days during the COMP condition. Absences of greater than five days occurred between the following sessions:

2-3; 5-6; 7-8; 8-9; 11-12; 12-13; 14-15; 16-17;
18-19; 21-22; 24-25.

APPENDIX E

INDIVIDUAL REVIEW AND MAINTENANCE DATA

APPENDIX E

Review and Maintenance Data for Individual Children

Child	Condition (In order Administered)	% Correct Review	% Correct Maintenance
S1	IM/COMP	70%	N/A *
	COMP/IM	98%	95%
	SIM	89%	N/A *
S2	IM/COMP	100%	75%
	SIM	100%	100%
	COMP/IM	100%	100%
S3	SIM	100%	90%
	IM/COMP	82%	95%
S4	SIM	75%	58%
	COMP/IM	80%	86%
S5	COMP/IM	92%	100%
	IM/COMP	93%	N/A *
S6	COMP/IM	95%	70%

* N/A Indicates incomplete data available due to end of a school term

IM/COMP - Imitation/Comprehension Condition
COMP/IM - Comprehension/Imitation Condition
SIM - Simultaneous